

Allen-Bradley

Ultra3000 Digital Servo Drives

(Catalog Numbers
2098-DSD-005, -010, and -020
2098-DSD-xxxX
2098-DSD-xxx-SE
2098-DSD-xxx-DN
2098-DSD-xxxX-DN

2098-DSD-030, -075, and -150
2098-DSD-xxxX
2098-DSD-xxx-SE
2098-DSD-xxx-DN
2098-DSD-xxxX-DN

2098-DSD-HV030, -HV050, -HV100, -HV150,
and -HV220
2098-DSD-HVxxxX
2098-DSD-HVxxx-SE
2098-DSD-HVxxx-DN
2098-DSD-HVxxxX-DN)

Integration Manual

**Rockwell
Automation**

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley® does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
 - avoid a hazard
 - recognize the consequences
-

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

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Preface

Introduction

Read this preface to familiarize yourself with the rest of the manual. This preface contains the following topics:

- Who Should Use this Manual
- Purpose of this Manual
- Contents of this Manual
- Product Receiving and Storage Responsibility
- Related Documentation
- Conventions Used in this Manual
- Allen-Bradley Support

Who Should Use this Manual

This manual is intended for engineers or programmers directly involved in the operation, field maintenance, and integration of the Ultra™3000 Digital Servo Drives (DSD).

If you do not have a basic understanding of the Ultra3000, contact your local Allen-Bradley representative for information on available training courses before using this product.

Purpose of this Manual

This manual provides power up procedures, system integration, and troubleshooting tables for the Ultra3000. The purpose of this manual is to assist you in the integration of your Ultra3000 as a stand alone drive using Ultraware or with a Logix controller using RSLogix® 5000 software as outlined in the table below.

Drive Type	Catalog Numbers	Command Interface	Software
SERCOS interface™ drive	2098-DSD-xxx-SE and -HVxxx-SE	Fiber-optic SERCOS ring	RSLogix 5000
Analog drive	2098-DSD-xxx and -HVxxx-	Analog command interface	Ultraware or RSLogix 5000
Digital drive with DeviceNet™	2098-DSD-xxx-DN and -HVxxx-DN	DeviceNet communication interface	Ultraware
Indexing drive	2098-DSD-xxxX and -HVxxxX	Stand alone control	
Indexing DeviceNet drives	2098-DSD-xxxX-DN and -HVxxxX-DN		

Contents of this Manual

Refer to the following listing for the descriptive contents of this installation manual.

Chapter	Title	Contents
	<i>Preface</i>	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	<i>Commissioning Your Ultra3000</i>	Provides steps to follow when configuring your Ultra3000 and when applying power to the Ultra3000 for the first time.
2	<i>Troubleshooting Your Ultra3000</i>	Provides diagnostic aids that help isolate problems with your drive.
Appendix A	<i>Interconnect Diagrams</i>	Provides power and signal interconnect diagrams between the Ultra3000 and shunt modules, servo motors, and input power.
Appendix B	<i>Understanding Motor Feedback Signals and Outputs</i>	Provides motor encoder input signal information and drive encoder output information specific to the Ultra3000 drives.

Product Receiving and Storage Responsibility

You, the customer, are responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. If any items are obviously damaged, it is your responsibility to refuse delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Store the product in its shipping container prior to installation. If you are not going to use the equipment for a period of time, store using the following guidelines.

- Use a clean, dry location
- Maintain an ambient temperature range of -40 to 70° C (-40 to 158° F)
- Maintain a relative humidity range of 5% to 95%, non-condensing
- Store it where it cannot be exposed to a corrosive atmosphere
- Store it in a non-construction area

Related Documentation

The following documents contain additional information concerning related Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley office or distributor.

For:	Read This Document:	Catalog Number:
The instructions needed for the installation and wiring of the Ultra3000	<i>Ultra3000 Digital Servo Drives Installation Manual</i>	2098-IN003x-EN-P
Ultraware Installation Instructions	<i>Ultraware CD Installation Instructions</i>	2098-IN002x-EN-P
Information on configuring your Ultra3000 using Ultraware	<i>Ultraware User Manual</i>	2098-UM001x-EN-P
Information on communicating with the Ultra3000 using DeviceNet	<i>Ultra3000 DeviceNet Reference Manual</i>	2098-RM001x-EN-P
Information on attaching Ultra3000 drives to a DeviceNet network	<i>DeviceNet Cable System Planning and Installation Manual</i>	DN-6.7.2
A description and specifications for the Ultra Family including motors and motor accessories	<i>Kinetix® Motion Control Selection Guide</i>	GMC-SG001x-EN-P
Drive and motor sizing with application analysis software	<i>Motion Analyzer CD</i> (v4.1 or above)	PST-SG003x-EN-C
More detailed information on the use of ControlLogix® motion features and application examples	<i>ControlLogix Motion Module Programming Manual</i>	1756-RM086x-EN-P
ControlLogix SERCOS interface module installation instructions	<i>3, 8 or 16 Axis SERCOS interface Module Installation Instructions</i>	1756-IN572x-EN-P
ControlLogix Analog Encoder Servo module installation instructions	<i>Analog Encoder (AE) Servo Module Installation Instructions</i>	1756-IN047x-EN-P
SoftLogix SERCOS interface PCI card installation instructions	<i>16 Axis PCI SERCOS interface Card Installation Instructions</i>	1784-IN041x-EN-P
SoftLogix Analog Encoder PCI card installation instructions	<i>PCI 2 Axis Servo Card Installation Instructions</i>	1784-IN005x-EN-P
The instructions needed to program a motion application	<i>Logix Controller Motion Instruction Set Reference Manual</i>	1756-RM007x-EN-P
Information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Information on configuring and troubleshooting your SoftLogix PCI card	<i>SoftLogix Motion Card Setup and Configuration Manual</i>	1784-UM003x-EN-P
Information on proper handling, installing, testing, and troubleshooting fiber-optic cables	<i>Fiber Optic Cable Installation and Handling Instructions</i>	2090-IN010x-EN-P
Information, examples, and techniques designed to minimize system failures caused by electrical noise	<i>System Design for Control of Electrical Noise Reference Manual</i>	GMC-RM001x-EN-P
For declarations of conformity (DoC) currently available from Rockwell Automation	Rockwell Automation Product Certification website	www.ab.com/certification/ce/docs
An article on wire sizes and types for grounding electrical equipment	<i>National Electrical Code</i>	Published by the National Fire Protection Association of Boston, MA.
A glossary of industrial automation terms and abbreviations	<i>Allen-Bradley Industrial Automation Glossary</i>	AG-7.1

Conventions Used in this Manual

The following conventions are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps
- Numbered lists provide sequential steps or hierarchical information
- Words that you type or select appear in bold
- When we refer you to another location, the section or chapter name appears in italics
- Abbreviations for the Ultra3000 drives, shown in the table below, are used throughout this manual

Ultra3000 Drive	Abbreviation
Ultra3000 with SERCOS interface	Ultra3000-SE
Ultra3000 with DeviceNet interface	Ultra3000-DN

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in the chapter Troubleshooting Status Indicators first, then call your local Allen-Bradley representative or Rockwell Automation Technical Support at (440)-646-5800. For the quickest possible response, please have the catalog numbers of your products available when you call.

Comments Regarding this Manual

To offer comments regarding the contents of this manual, go to www.ab.com/manuals/gmc and download the Motion Control Problem Report form. Mail or fax your comments to the address/fax number given on the form.

Commissioning Your Ultra3000

Chapter Objectives

This chapter provides you with information to apply power and configure your Ultra3000. This chapter includes these sections:

- General Startup Precautions
- Before You Begin
- Configuring Your Ultra3000 and Ultra3000 with Indexing
- Configuring Your Ultra3000 with SERCOS interface Drive
- Configuring Your Ultra3000 with DeviceNet Drive

Note: Some of the procedures in this chapter include information regarding integration with other products.

General Startup Precautions

The following precautions pertain to all of the procedures in this chapter. Be sure to read and thoroughly understand them before proceeding.

ATTENTION

This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltages on the system bus network have been discharged before attempting to service, repair or remove this unit. Only qualified personnel familiar with solid state control equipment and safety procedures in publication NFPA 70E or applicable local codes should attempt this procedure.

ATTENTION

This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. You are required to follow static control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD Protection Handbook.

Before You Begin

These procedures assume you have completed mounting, wiring, and connecting your Ultra3000 drive as described in the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the table below to determine where to begin configuring your Ultra3000 drive.

If you are configuring this drive:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX	Go to <i>Configuring Your Ultra3000 and Ultra3000 with Indexing</i>
2098-DSD-xxx-SE or -HVxxx-SE	Go to <i>Configuring Your Ultra3000 Drive</i>
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or -HVxxxX-DN	Go to <i>Configuring Your Ultra3000 with DeviceNet Drive</i>

Configuring Your Ultra3000 and Ultra3000 with Indexing

The procedures in this section apply to Ultra3000 drives (2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX) and describe how to:

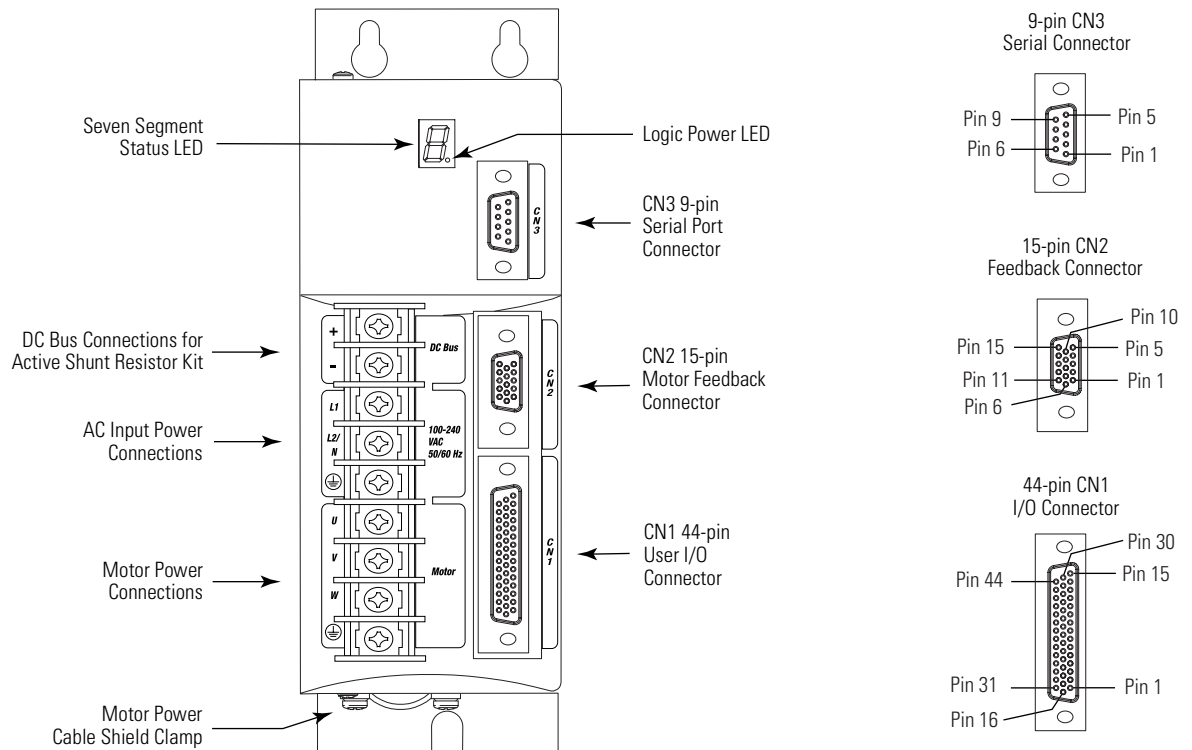
- Apply power to your Ultra3000 drive
- Detect your Ultra3000 drive
- Understand the workspace and drive branches in Ultraware
- Select your motor
- Tune your motor
- Test your motor (non-indexing move)
- Test your motor (indexing move)
- Make indexing and non-indexing moves
- Configure your Ultra3000 drive with the Logix servo module

Front Panel Connections

This section provides front panel connection information for your Ultra3000 and Ultra3000 with indexing drive.

Use the figure below to locate the front panel connections on the Ultra3000 230V drives (500W, 1 kW, and 2 kW).

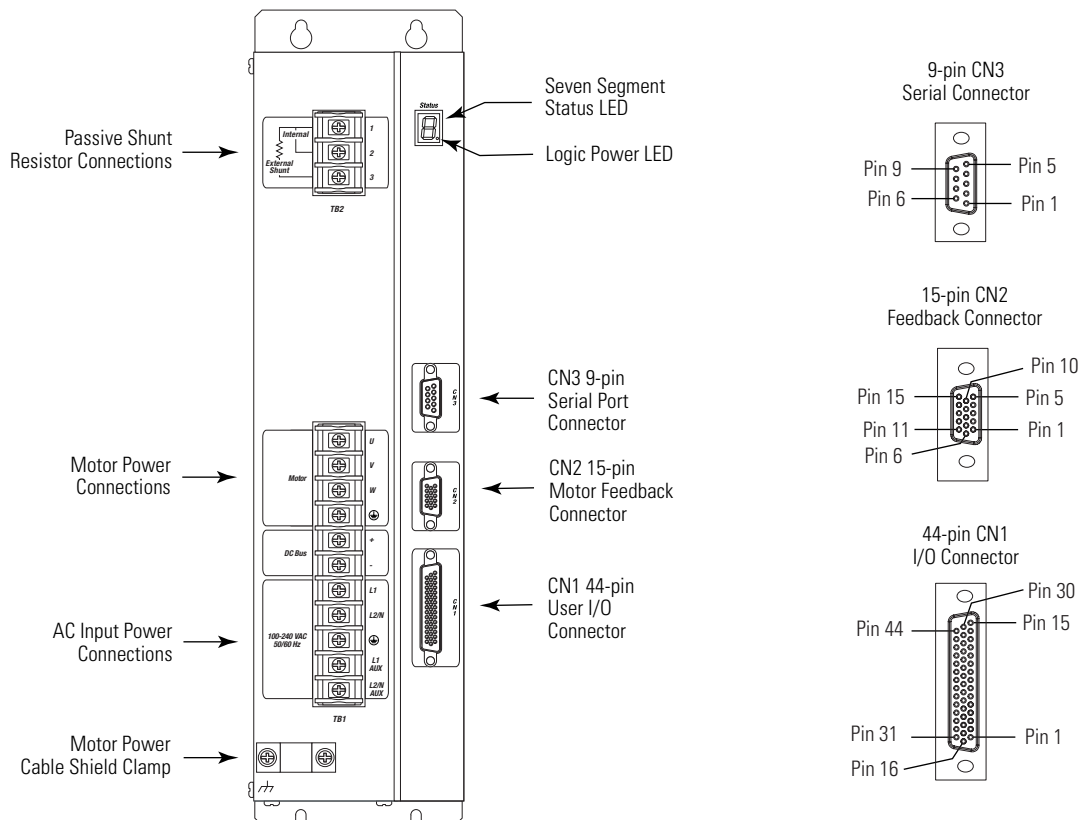
Figure 1.1
Ultra3000 Front Panel Connections
for 2098-DSD-005, -005X, -010, -010X, -020, and -020X



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000 230V drives (3 kW).

Figure 1.2
Ultra3000 Front Panel Connections for 2098-DSD-030 and -030X

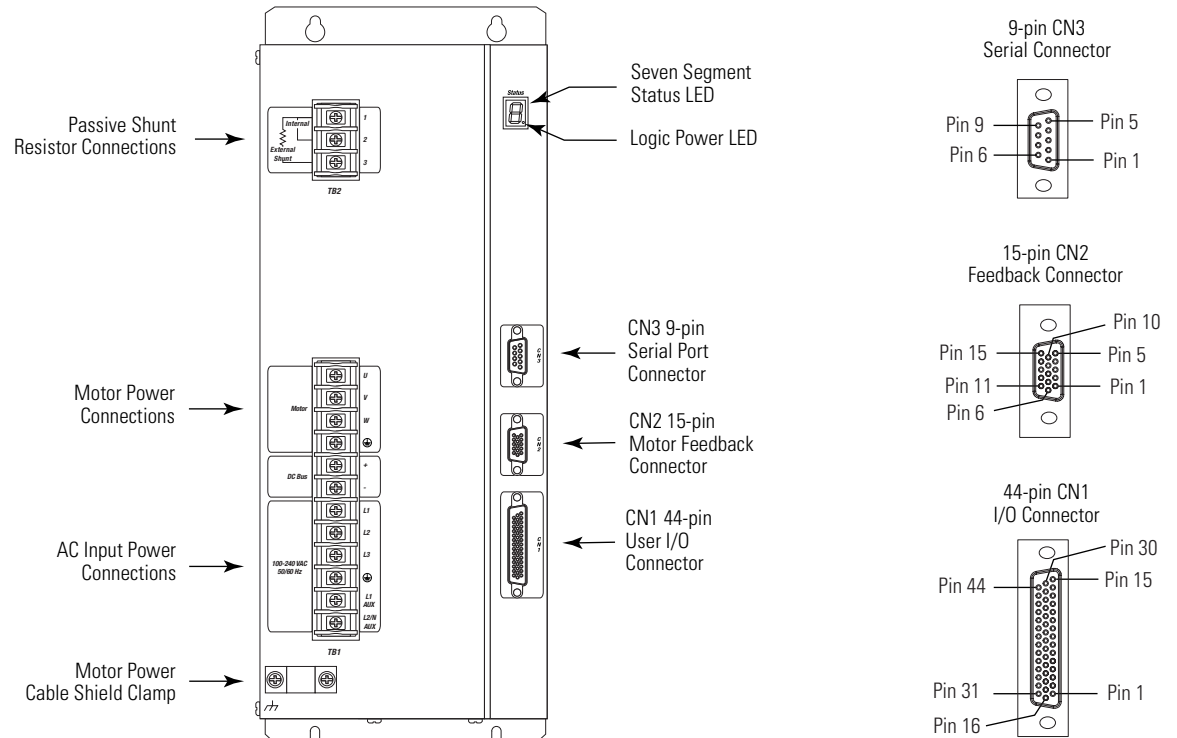


For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000 230V (7.5 and 15 kW).

Figure 1.3

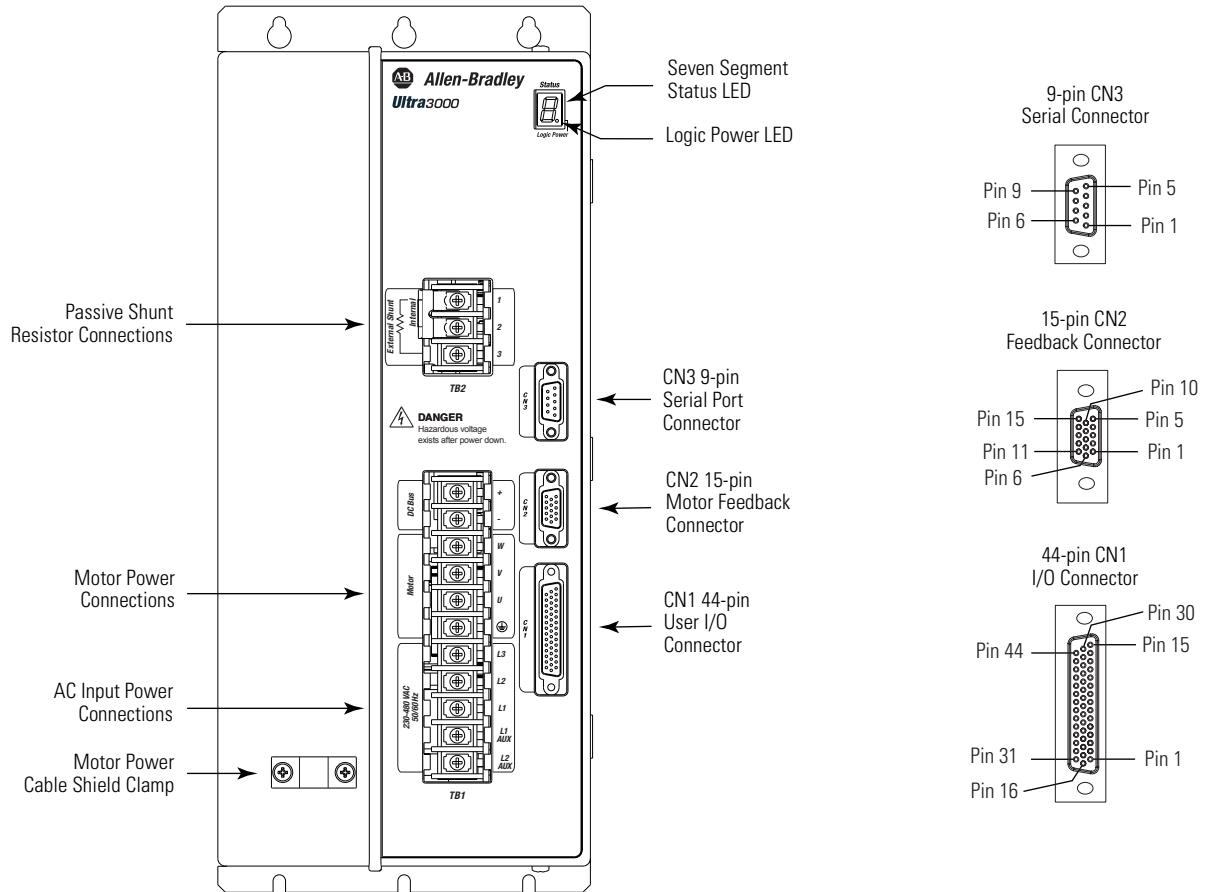
Ultra3000 Front Panel Connections for 2098-DSD-075, -075X, -150, and -150X



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000 460V drives (3W, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.4
Ultra3000 Front Panel Connections for 2098-DSD-HVxxx and HVxxxX



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Applying Power To Your Ultra3000 Drive

This procedure assumes you have wired your Ultra3000 system, verified the wiring, and are ready to begin using your Ultraware software.

ATTENTION



High voltage exists in AC line filters. The filter must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels. Failure to observe this precaution could result in personal injury.

To apply power to your Ultra3000 drive:

1. Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.

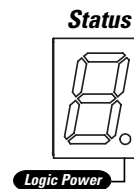
ATTENTION



To avoid damage to the drive due to improper sequencing of input power and the Drive Enable (Input 1) signal, do not apply Drive Enable signal without first applying input power.

2. Apply input power to the Ultra3000 and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.5
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	<ol style="list-style-type: none"> 1. Check your input power connections. 2. Repeat main step 2.

3. Observe the front panel seven segment Status LED display as shown in Figure 1.5.

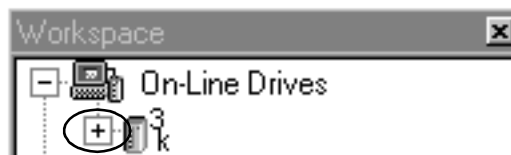
If the Status LED display on your:	Is:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX drive	Actively cycling segments in a full circle	The drive is ready. Go to <i>Detecting Your Ultra3000 Drive</i> on page 1-8.
	Flashing an E followed by two numbers	Go to <i>Error Codes</i> on page 2-2.

Detecting Your Ultra3000 Drive

This procedure assumes you have successfully applied power to your drive. By following these steps you will ensure that your Ultra3000 drive is communicating with your Ultraware software. To detect your Ultra3000 drive:

1. Start your Ultraware software. Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on starting the Ultraware software.
2. Create a new file. Ultraware will scan for on-line drives.
3. Click on the Stop Scanning button when your drive is detected or wait for the scanning to time out.
4. Look for the Ultra3000 icon (Ultra3k) under the On-Line Drives tree. The Ultra3000 icon indicates that your drive is detected.

Figure 1.6
Ultra3000 Icon



5. Click on the [+] next to the Ultra3k icon to expand the branch menu (as indicated in the window above).

6.

If your Ultra3000 drive:	Then:
Is detected and listed under the On-Line Drives tree	<ol style="list-style-type: none"> 1. The software and hardware are communicating and the system is ready. 2. Go to the section <i>Selecting a Motor</i>.
Is not detected	<ol style="list-style-type: none"> 1. Check your serial cable connections. 2. Use Recover Communications... (in Ultraware) to establish a connection. 3. Go to main step 1 of this section.

Understanding the Workspace and Drive Branches

This section provides a description of the Ultraware workspace and various drive branches.

Click on the next to the (3k) drive to expand the parameter group.

Double-click on the (3k) drive in the Ultraware workspace to display the various drive branches.

Configure the drive parameters for an off-line or on-line drive.

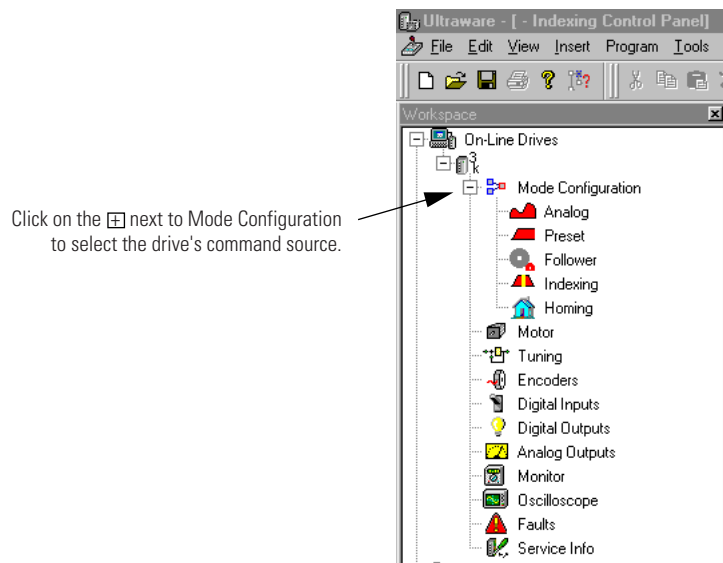
Open the Control Panel windows to issue motion commands.

Execute commands to clear faults, reset the drive, or reset the EEPROM.

Monitor the status of an on-line drive.

The screenshot shows the 'Workspace' window with a tree view under 'On-Line Drives'. The 'Drive' branch is expanded, showing sub-items like 'Mode Configuration', 'Motor', 'Tuning', 'Encoders', 'Digital Inputs', 'Analog Outputs', 'Monitor', 'Oscilloscope', 'Faults', 'Service Info', and 'New Drive.udb'. The 'Parameter' window is open, displaying a list of parameters and their values. The 'Status' window shows the current status of the drive, including 'Drive Enabled', 'In Position', 'In Position Window', 'Up To Speed', and 'In Speed Window'. The 'Control Panel' window is also visible, showing buttons for 'Velocity Control Panel...', 'Current Control Panel...', 'Indexing Control Panel...', 'Clear Faults', 'Reset Drive', and 'Reset EEPROM to Factory Settings'.

Mode Configuration Branch



Motor Branch

Use the Motor Branch to:

- Select a motor for the associated on-line or off-line Ultra3000 drive. Once you select a motor, the status values associated with the selected motor appears in the Status pane of this window.
- Monitor the status as related to the selected motor.
- Perform diagnostics on the motor

Note: Diagnostic commands are not available for SERCOS drives.

Tuning Branch

Use the Tuning Branch to:

- Configure Velocity and Position Regulator Gains that are used in tuning.
- Monitor Velocity, Position, and Current loop status.
- Open windows where you can execute commands for autotuning, manual position tuning, and manual velocity tuning.

Encoders Branch

Use the Encoders Branch to:

- Define the motor and auxiliary encoders.
- Configure the motor encoder and optional auxiliary encoder.

Digital Inputs Branch

Use the Digital Inputs Branch to:

- Assign functionality to digital inputs.
- Monitor the status of digital inputs.

Digital Outputs Branch

Use the Digital Outputs Branch to:

- Assign functionality to digital outputs.
- Set both active and inactive brake delays.
- Monitor the status of digital outputs and the digital relay.
- Open other windows where you can override the state of digital outputs and the relay.

Analog Outputs Branch

Use the Analog Outputs Branch to:

- Assign drive signals to analog outputs
- Monitor the status of Analog Outputs
- Open a window where you can monitor and override the analog output value.

Monitor Branch

Use the Monitor Branch to:

- View a collection of statuses.
- Open the Monitor Setup window where you can select the collection of statuses to display in this window.
- Load a monitor previously saved.
- Save a monitor for later use.

Oscilloscope Branch

Use the Oscilloscope Branch to trace one of four drive signals by:

- Configuring the oscilloscope by selecting a the drive signal to trace.
- Executing commands that run the oscilloscope's tracing function continuously or in response to the configured trigger.
- Monitoring the oscilloscope as it traces the selected drive signal.

Faults Branch

Use the Faults Branch to:

- Set fault limits
- Monitor fault status
- Execute the Clear Faults command
- Open a window where you can review the drive's fault history
- Enable or disable user faults.

Service Information Branch

Use the Service Information Branch to:

- Modify the size of an off-line drive file before transferring the configuration to an on-line drive.
- Display and monitor service information about the drive.
- Display the firmware version of the drive.

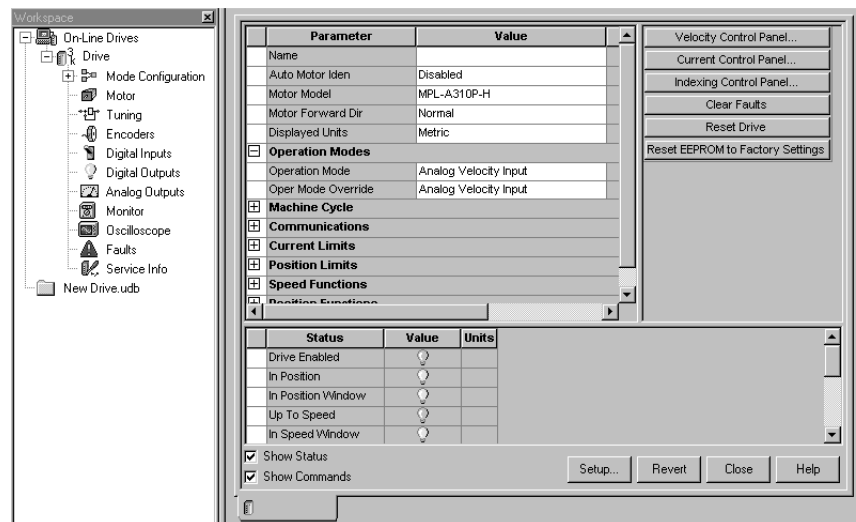
Selecting a Motor

This procedure assumes you have power applied to your drive and the drive is detected by the Ultraware software.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on selecting a motor.

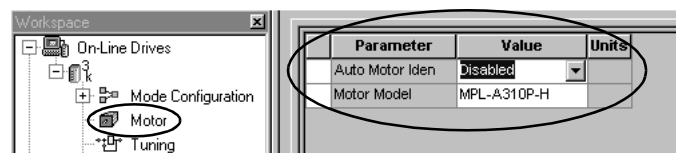
To select a motor:

1. Double click on the Ultra3000 icon (Ultra3k) under the On-Line Drives tree. The Ultra3000 Drive properties window opens.



Note: Actual values depend on your application.

2. Double click on the Motor branch. The motor branch property window opens.



- 3.

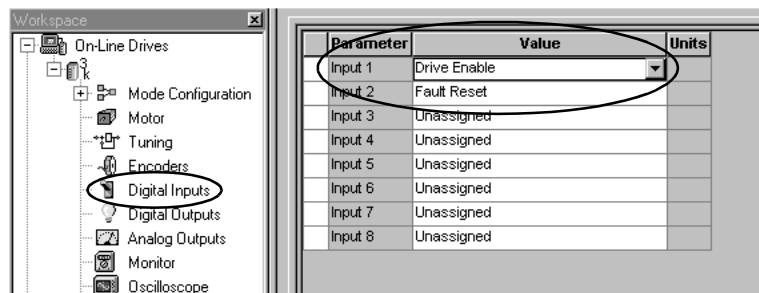
If you have this motor:	Then:
An Allen-Bradley motor with an intelligent encoder	Leave Auto Motor Iden Enabled and go to step 1.
All others	Select Auto Motor Iden Disabled and go to main step 4.

4. In the box next to Motor Model, select the model number of your motor.
5. Close the Motor properties window.

Assigning Digital Inputs

To assign Digital Inputs 1 and 2:

1. Double-click on the Digital Inputs branch. The Digital Inputs properties window opens.



2. Set Input 1 value to **Drive Enable**.

ATTENTION



To avoid fault action or damage to the drive due to improper sequencing of input power and the Drive Enable signal, you must assign one of the eight inputs as Drive Enable (Input 1 is the default setting).

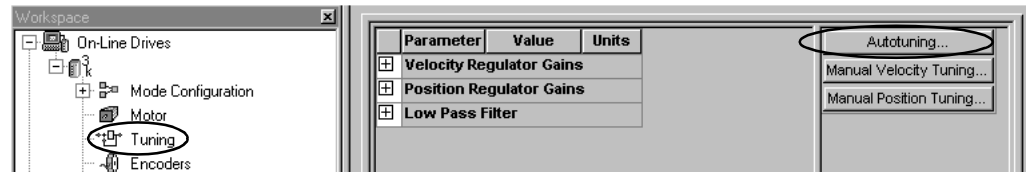
3. Set Input 2 value to **Fault Reset**.
4. Close the Digital Inputs window.

Tuning Your Motor

This procedure assumes your drive is detected and you have selected a motor. In this procedure you will autotune your motor.

To autotune your motor:

1. Double-click on the Tuning branch. The Tuning branch properties window opens.



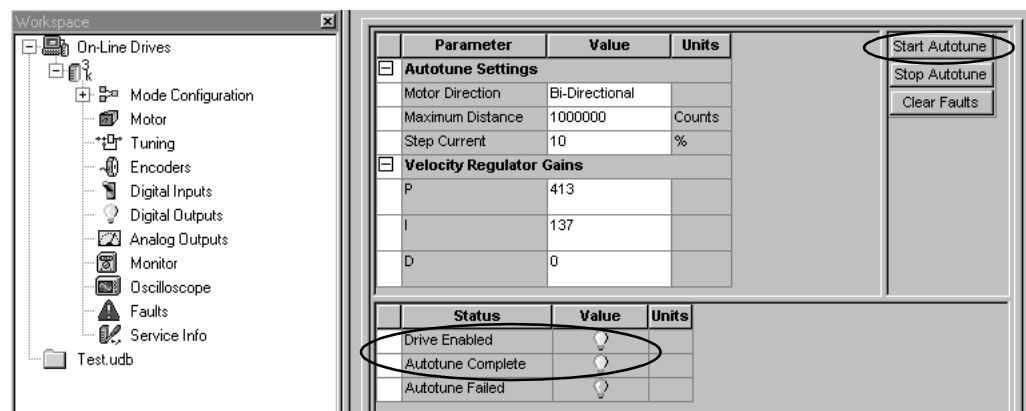
2. Select **Autotuning**. The Autotuning window opens.
3. Apply 12-24V to input 1. Input 1 was configured as Drive Enable in a previous step (Drive Enabled light turns yellow).

ATTENTION



To avoid damage to the drive due to improper sequencing of input power and the Drive Enable signal, do not apply Drive Enable signal without first applying input power.

4. Select appropriate autotune settings for your application.
5. Select **Start Autotune**. The motor responds and the tuning process is complete (Autotune Complete light turns yellow).



Note: Actual values depend on your application.

6. Close the Tuning properties window.

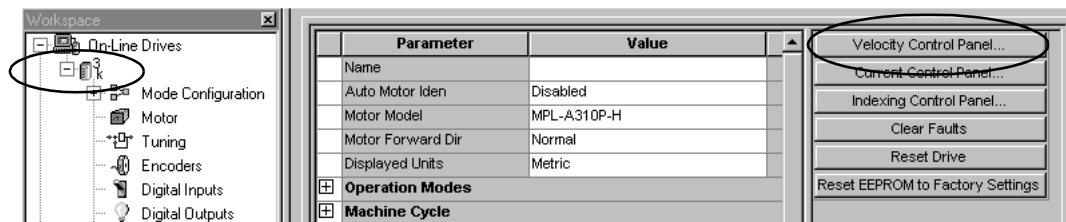
Testing Your Motor (Non-Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have selected a motor. In this procedure you will enable the drive and set the motor velocity to test the motor.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on using the velocity control panel.

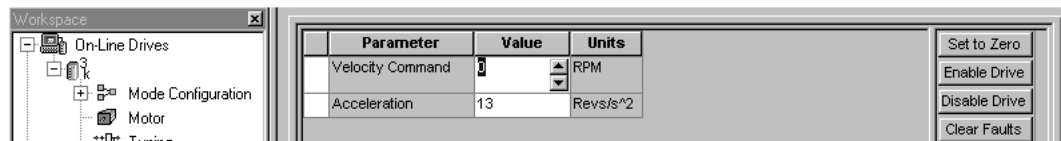
To test your motor:

1. Double-click the U3k icon. The drive properties window opens.

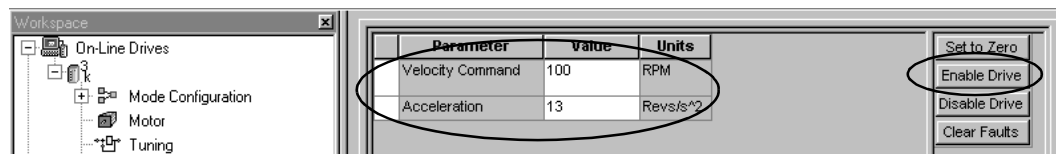


Note: Actual values depend on your application.

2. Select **Velocity Control Panel** (as indicated in the window above). The velocity control panel window opens.

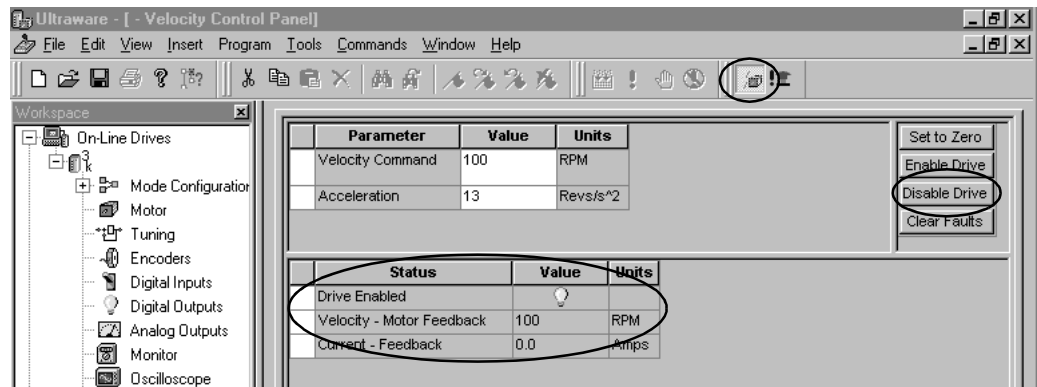


3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Select **Enable Drive** (as indicated in the window below).



5. Enter an appropriate low speed in the velocity command value field.
6. Press **Enter**.
7. Observe the motor. The motor should be turning at the velocity you entered in step 5.

8. Observe the Status table (as indicated below).



- Drive Enable status = lamp is on (yellow)
- Velocity - Motor Feedback status = the value you entered in step 5.

9. Select **Disable Drive**. The motor stops.

10. Close the velocity control panel.

11. Select the **Enable** icon from the Ultraware toolbar.

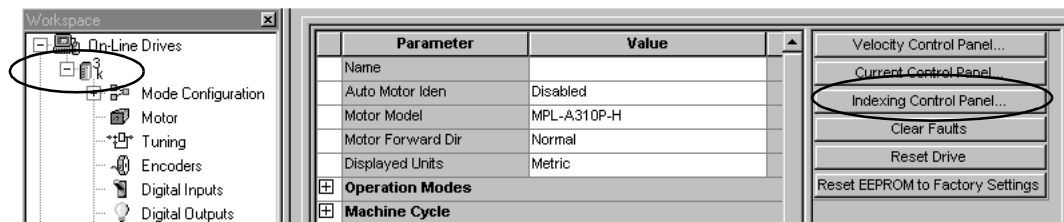
Testing Your Motor (Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have selected a motor. In this procedure you will enable the drive and make an incremental move to test the motor.

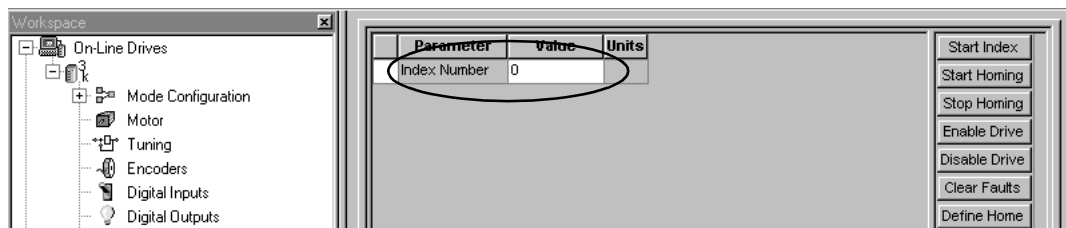
Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on using the indexing control panel.

To test your motor:

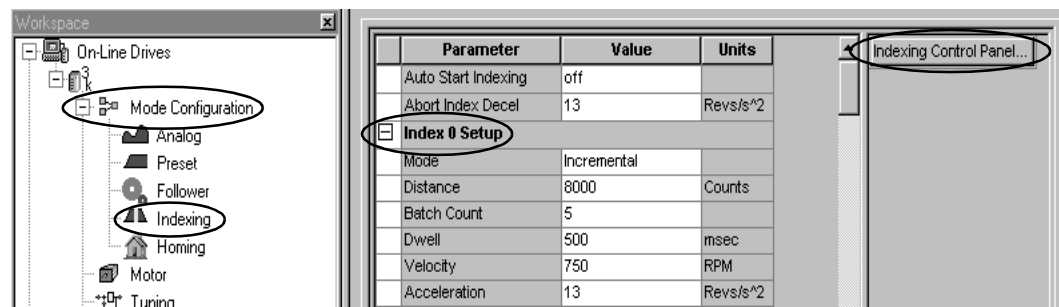
1. Double-click the U3k icon. The drive properties window opens.



2. Select **Indexing Control Panel** (as indicated in the window above). The indexing control panel window opens.



3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Set the value of **Index Number** to 0.
5. Expand the **Mode Configuration** branch (as indicated in the window below) and double-click on Indexing. The Indexing Setup window opens.

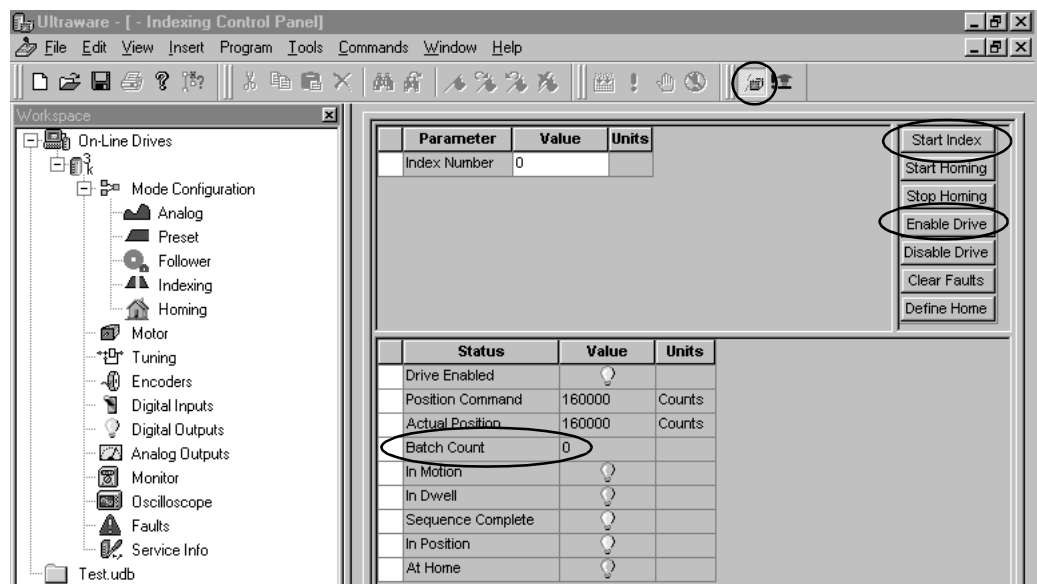


6. Expand **Index 0 Setup**. Configure your incremental move with the following values for Index 0:

- Mode = Incremental
- Distance = 8000 counts
- Batch count = 5
- Dwell = 500 ms
- Action When Complete = Stop
- Leave other defaulted parameters as is

Note: These settings may not be appropriate for your application.

7. Select **Indexing Control Panel**. The indexing control panel opens.



8. Select **Enable Drive**.
9. Select **Start Index**. Your incremental move begins.
10. Observe the Batch Count value count down from 5 to 0 while your move is running.
11. Close the indexing control panel window.
12. Close the indexing mode window.
13. Select the **Enable** icon from the Ultraware toolbar.

Indexing and Non-Indexing Move Examples

This section provides examples of indexing and non-indexing moves you can make with your Ultra3000 drive using Ultraware.

Analog Velocity Mode (Non-Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have tested a motor. In this procedure you will run the drive in analog velocity mode.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on analog velocity mode.

To run your drive in analog velocity mode:

1. Double-click the U3k icon. The drive properties window opens.
2. Expand the **Operation Modes** parameter. Verify the Operation Mode is Analog Velocity Input.

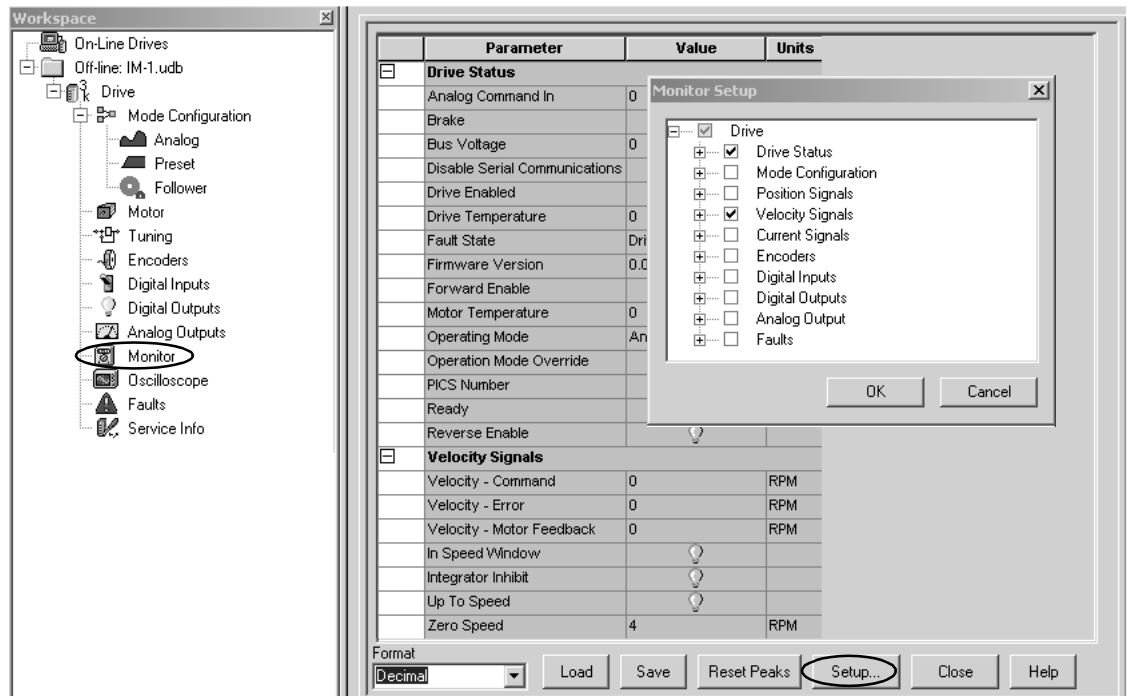
	Parameter	Value	Units
	Name	Drive	
	Auto Motor Iden	Enabled	
	Motor Model		
	Motor Forward Dir	Normal	
	Displayed Units	Metric	
[-]	Operation Modes		
	Operation Mode	Analog Velocity Input	
	Oper Mode Override	Analog Velocity Input	
[+]	Machine Cycle		

3. Close the Drive Branch user window.
4. Expand the **Mode Configuration** branch. Double-click Analog. The Analog Setup window opens.

	Parameter	Value	Units
[-]	Velocity Command Input		
	Velocity Scale	300.0	RPM/Volt
	Velocity Offset	0	millivolts
	Accel/Decel Limits	Inactive	
	Accel Limit	13	Revs/s^2
	Decel Limit	13	Revs/s^2
[-]	Current Command Input		
	Current Scale	0.75	Amps/Volt
	Current Offset	0	millivolts
[-]	Position Command Input		
	Position Scale	1000.0	Counts/Volt
	Position Offset	0	millivolts

5. Set the **Velocity Scale** to 300.0 RPM/Volt. Verify **Velocity Offset** is 0 millivolts.

6. Double-click on the **Digital Inputs** branch.
 - Verify that Input 1 is configured as **Drive Enable** input (factory default).
 - Verify that Input 2 is configured as the **Fault Reset** input.
7. Double-click on the **Monitor** branch. The (default) Drive Status parameters display.



8. Select **Setup**. The Monitor Setup window opens. Check **Velocity Signals**.
9. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
10. Observe the drive respond to a ± 10 V dc analog signal applied to CN1-25 and -26.
 - Analog Command voltage
 - Velocity Command rpm (300 rpm/analog input voltage)
11. Remove the 12-24V dc (Drive Enable) from input 1.

Preset Velocity Control (Non-Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have tested a motor. In this procedure you will run the drive using preset velocity control.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on preset velocity control.

To use preset velocity control:

1. Double-click the U3k icon. The drive properties window opens.
2. Expand the **Operation Modes** parameter. Click on the current setting and use the drop down arrow to change the Operation Mode to **Preset Velocity**.

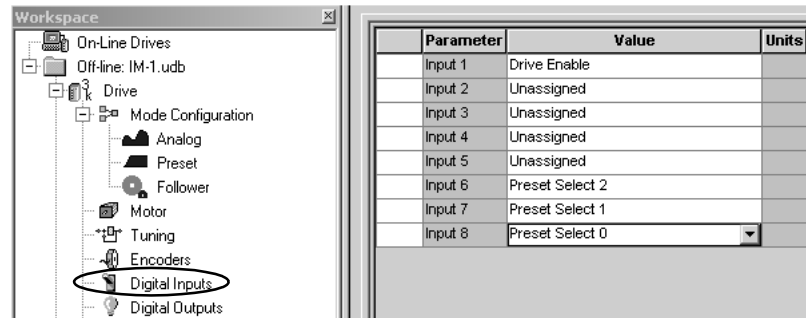
	Parameter	Value
	Name	Drive
	Auto Motor Iden	Enabled
	Motor Model	
	Motor Forward Dir	Normal
	Displayed Units	Metric
[-]	Operation Modes	
	Operation Mode	Preset Velocity
	Oper Mode Override	Analog Velocity Input
[+]	Machine Cycle	

3. Close the Drive Branch user window.
4. Expand the **Mode Configuration** branch and double-click on Preset. The Preset setup window opens.

	Parameter	Value	Units
[-]	Preset Velocities		
	Preset 0	10	RPM
	Preset 1	100	RPM
	Preset 2	1000	RPM
	Preset 3	0	RPM
	Preset 4	-10	RPM
	Preset 5	-100	RPM
	Preset 6	-1000	RPM
	Preset 7	0	RPM
[-]	Preset Velocity Input Limits		
	Accel/Decel Limits	Inactive	
	Acceleration	13	Revs/s ²
	Deceleration	13	Revs/s ²

5. Enter the Preset Velocity values as shown in the table above.
6. Set the Preset Velocity Input Limits value to **Inactive**, as shown in the table above.
7. Close the user windows.

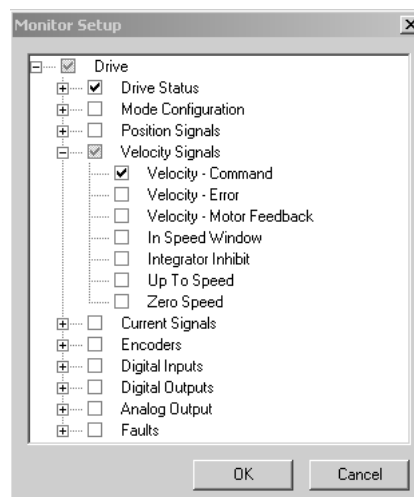
8. Double-click the **Digital Inputs** branch. Use the drop-down arrows to change the input values as shown in the table below.



9. Select a preset location by placing 12-24V dc on the assigned preset input according to the table below.

Preset Selects	Binary Code						Selected Preset or Index
	5	4	3	2	1	0	
Select up to 64 locations via preselect inputs 5 through 0 using BCD format. (codes for preset selects 1 and 0 are shown)	0	0	0	0	0	0	Preset 0 or Index 0 is selected.
	0	0	0	0	0	1	Preset 1 or Index 1 is selected.
	0	0	0	0	1	0	Preset 2 or Index 2 is selected.
	0	0	0	0	1	1	Preset 3 or Index 3 is selected.
	↓						↓
	1	1	1	1	1	1	Preset 64 or Index 64 is selected.

10. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
11. Observe the motor running at the selected speed (rpm).
12. Double-click the **Monitor** branch. Select **Setup** and expand the Velocity Signals branch.



13. Check **Velocity - Command** and click **OK**.
14. Go to the **Monitor Branch** and verify the **Velocity - Command** signal coincides with the selected preset value.
15. Remove the 12-24V dc (Drive Enable) from input 1.

Master Follower and Preset Gear Ratios (Non-Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have tested a motor. Also assumed is an external auxiliary incremental encoder wired to CN1-1 and -2 (power) and CN1-4, through -9 (encoder signals). In this procedure you will run the drive in position follower (Master Encoder) mode.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on position follower mode.

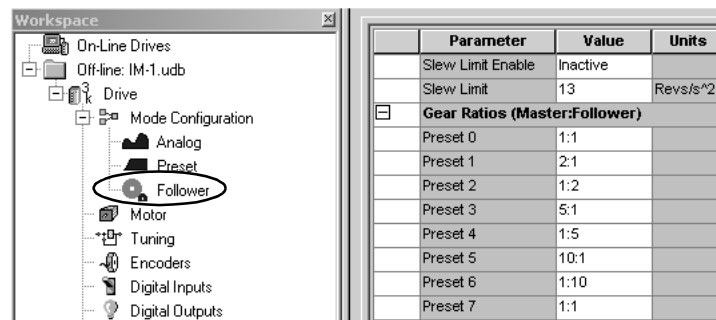
To run the drive in position follower mode:

1. Double-click the U3k icon. The drive properties window opens.
2. Expand the **Operation Modes** parameter. Click on the current setting and use the drop down arrow to change the Operation Mode to **Follower: Auxiliary Encoder**.

	Parameter	Value	Units
	Name	Drive	
	Auto Motor Iden	Enabled	
	Motor Model		
	Motor Forward Dir	Normal	
	Displayed Units	Metric	
<input type="checkbox"/>	Operation Modes		
	Operation Mode	Follower: Auxiliary Encoder	
	Oper Mode Override	Analog Velocity Input	
<input type="checkbox"/>	Machine Cycle		
<input type="checkbox"/>	Communications		
<input type="checkbox"/>	Current Limits		
<input type="checkbox"/>	Speed Functions		
<input type="checkbox"/>	Position Functions		
<input type="checkbox"/>	Display Precision		
<input type="checkbox"/>	Motor Encoder Units		
<input type="checkbox"/>	Auxiliary Encoder Units		

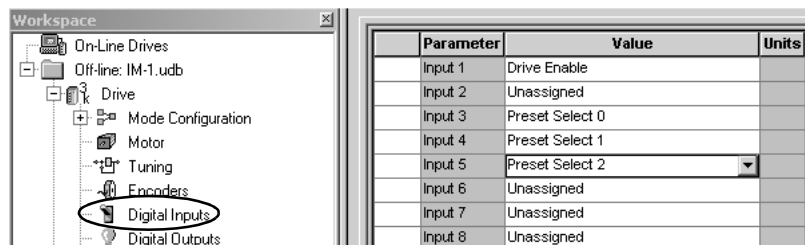
3. Close the Drive Branch user window.
4. Expand the **Mode Configuration** branch. Double-click on **Follower**.

5. Enter the Gear Ratio preset values as shown in the table below.



Parameter	Value	Units
Slew Limit Enable	Inactive	
Slew Limit	13	Revs/s ²
Gear Ratios (Master:Follower)		
Preset 0	1:1	
Preset 1	2:1	
Preset 2	1:2	
Preset 3	5:1	
Preset 4	1:5	
Preset 5	10:1	
Preset 6	1:10	
Preset 7	1:1	

6. Close the **Mode Configuration** window.
7. Double-click the **Digital Inputs** branch. Use the drop-down arrows to change the input values as shown in the table below.



Parameter	Value	Units
Input 1	Drive Enable	
Input 2	Unassigned	
Input 3	Preset Select 0	
Input 4	Preset Select 1	
Input 5	Preset Select 2	
Input 6	Unassigned	
Input 7	Unassigned	
Input 8	Unassigned	

8. Using BCD format (refer to the table on page 1-23) apply 12-24V dc to assigned inputs 3, 4, and 5 to select your preset.
9. Close the Digital Inputs user window.
10. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
11. Verify the rotation of the auxiliary encoder results in a corresponding move of the axis.
12. Remove the 12-24V dc (Drive Enable) from input 1.

Incremental Indexing (Indexing Move)

This procedure assumes you have applied power to your indexing drive, the Ultraware software is running, the drive is detected, and you have tested a motor. In this procedure you will run the drive in incremental indexing mode.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on incremental indexing moves.

To set parameters for an incremental indexing move:

1. Double-click the U3k icon. The drive properties window opens.
2. Expand the **Operation Modes** parameter. Click on the current setting and use the drop down arrow to change the Operation Mode to **Indexing**.

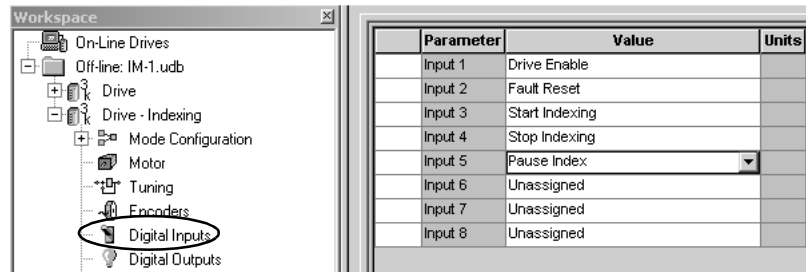
	Parameter	Value	Units
	Name	Drive - Indexing	
	Auto Motor Iden	Enabled	
	Motor Model		
	Motor Forward Dir	Normal	
	Displayed Units	Metric	
[-]	Operation Modes		
	Operation Mode	Indexing	
	Oper Mode Override	Analog Velocity Input	
[+]	Machine Cycle		

3. Close the Drive Branch user window.
4. Expand the **Mode Configuration** branch. Double-click on **Indexing**.
5. Enter the Index 0 parameter values as shown in the table below.

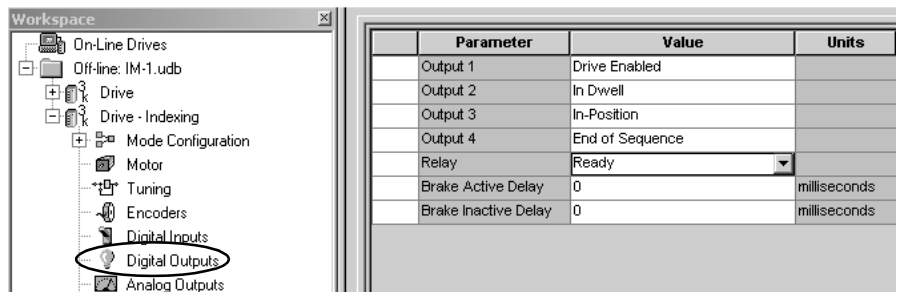
	Parameter	Value	U
	Auto Start Indexing	off	
	Abort Index Decel	13	Rev
[-]	Index 0 Setup		
	Mode	Incremental	
	Distance	4000	Cou
	Batch Count	10	
	Dwell	1000	mse
	Velocity	400	RPM
	Acceleration	12000	Rev
	Deceleration	3000	Rev
	Next Index	0	
	Action When Complete	Stop	

6. Close the Indexing Parameters user window.

7. Double-click the **Digital Inputs** branch. Use the drop-down arrows to change the input values as shown in the table below.



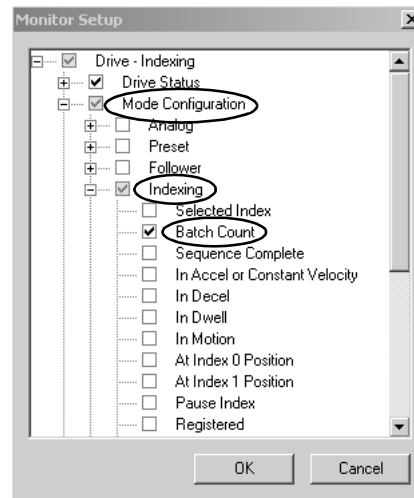
8. Close the Digital Inputs user window.
9. Double-click the **Digital Outputs** branch. Use the drop-down arrows to change the output values as shown in the table below.



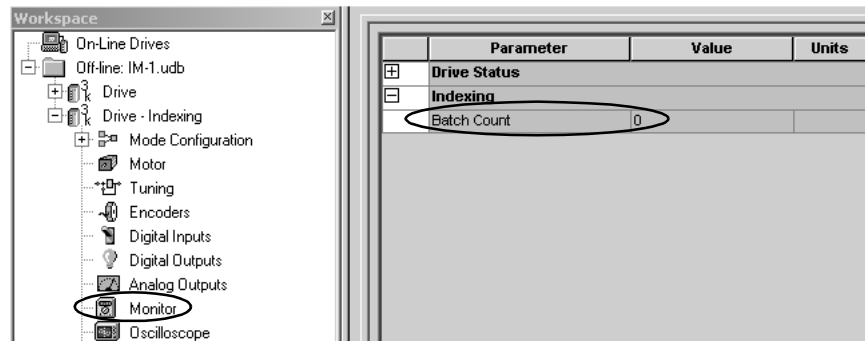
10. Close the Digital Outputs user window.

To verify the number of indexing moves using drive signals:

1. Double-click the **Monitor** branch. Select **Setup...** Expand the **Mode Configuration** branch/the **Indexing** branch/and check **Batch Count**.








2. Select **OK**.
3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Apply 12-24V dc to input 3 to the indexing move.



5. Double-click on the **Monitor** branch and watch Batch Count count down from 10 to 0.
6. Observe Outputs 2 and 3 for axis in dwell and in position.
7. Observe Output 4 when the Indexing move is complete.
8. Remove the 12-24V dc (Drive Enable) from input 1.

To use the stop indexing feature:

1. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
2. Apply 12-24V dc to input 3 to the indexing move.
3. Apply 12-24V dc to input 4 and verify that the indexing move has stopped.
4. Apply 12-24V dc to input 3 (again) and verify the original indexing move is re-initiated.
5. Apply 12-24V dc to input 5 and verify the index move is paused.
6. Double-click the **Digital Outputs** branch. Observe that Output 4 is not illuminated, indicating end of sequence has not been reached.

	Status	Value	Units
	Output 1 State		
	Output 2 State		
	Output 3 State		
	Output 4 State		
	Relay State		

7. Close the Digital Outputs user window.
8. Observe the **Monitor** branch to see that the Batch Count value is held at the remaining value.
9. Remove the 12-24V dc from Input 5 and verify the indexing move continues.
10. Close the user windows.
11. Remove the 12-24V dc (Drive Enable) from input 1.

Absolute Indexing (Indexing Move)

This procedure assumes you have applied power to your indexing drive, the Ultraware software is running, the drive is detected, and you have tested a motor. In this procedure you will run the drive in absolute indexing mode.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on absolute indexing moves.

To set parameters for an absolute indexing move:

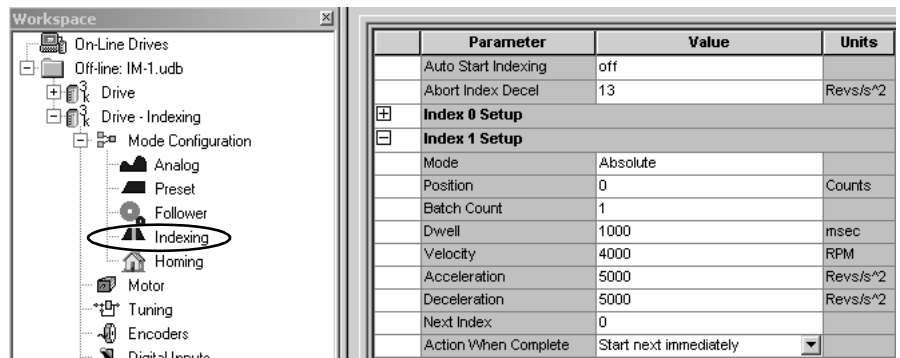
1. Double-click the U3k icon. The drive properties window opens.
2. Expand the **Operation Modes** parameter. Click on the current setting and use the drop down arrow to change the Operation Mode to **Indexing**.

	Parameter	Value	Units
	Name	Drive - Indexing	
	Auto Motor Iden	Enabled	
	Motor Model		
	Motor Forward Dir	Normal	
	Displayed Units	Metric	
[-]	Operation Modes		
	Operation Mode	Indexing	
	Oper Mode Override	Analog Velocity Input	
[+]	Machine Cycle		

3. Close the Drive Branch user window.
4. Expand the **Mode Configuration** branch. Double-click on **Indexing**.
5. Enter the Index 0 parameter values as shown in the table below.

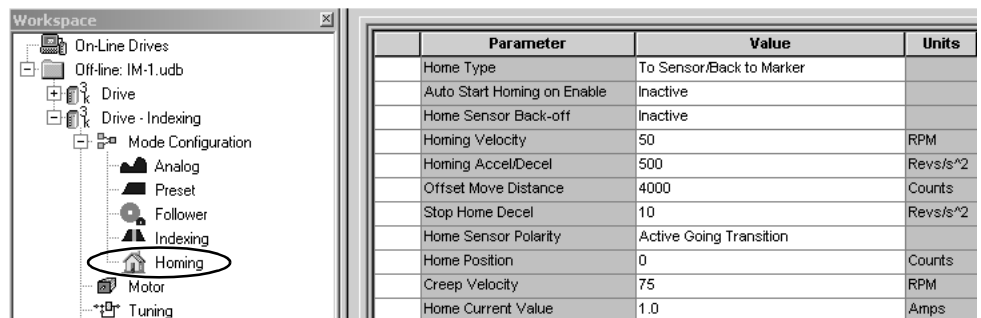
	Parameter	Value	Units
	Auto Start Indexing	off	
	Abort Index Decel	13	Revs/s ²
[-]	Index 0 Setup		
	Mode	Absolute	
	Position	8000	Counts
	Batch Count	1	
	Dwell	1000	msec
	Velocity	450	RPM
	Acceleration	500	Revs/s ²
	Deceleration	500	Revs/s ²
	Next Index	1	
	Action When Complete	Start next immediately	

6. Enter the Index 1 parameter values as shown in the table below.



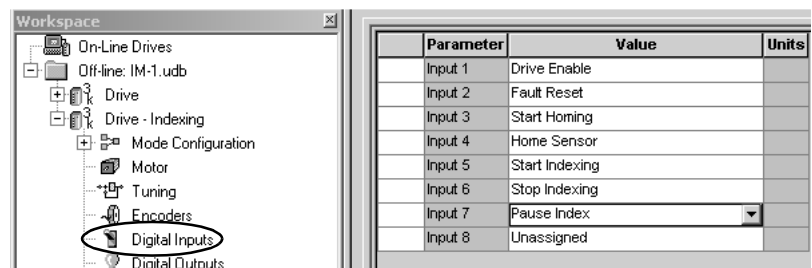
Parameter	Value	Units
Auto Start Indexing	off	
Abort Index Decel	13	Revs/s ²
Index 0 Setup		
Index 1 Setup		
Mode	Absolute	
Position	0	Counts
Batch Count	1	
Dwell	1000	msec
Velocity	4000	RPM
Acceleration	5000	Revs/s ²
Deceleration	5000	Revs/s ²
Next Index	0	
Action When Complete	Start next immediately	

7. Close the Indexing Parameters user window.
8. Expand the **Mode Configuration** branch. Double-click on **Homing**.
9. Enter the Homing parameter values as shown in the table below.



Parameter	Value	Units
Home Type	To Sensor/Back to Marker	
Auto Start Homing on Enable	Inactive	
Home Sensor Back-off	Inactive	
Homing Velocity	50	RPM
Homing Accel/Decel	500	Revs/s ²
Offset Move Distance	4000	Counts
Stop Home Decel	10	Revs/s ²
Home Sensor Polarity	Active Going Transition	
Home Position	0	Counts
Creep Velocity	75	RPM
Home Current Value	1.0	Amps

10. Close the Homing Parameters user window.
11. Close the Mode Configuration user window.
12. Double-click the **Digital Inputs** branch. Use the drop-down arrows to change the input values as shown in the table below.

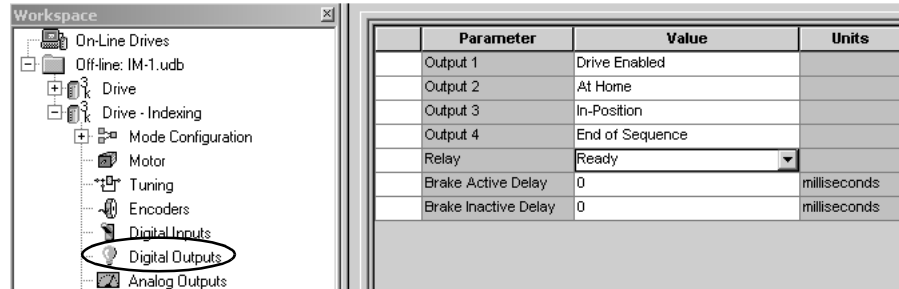


Parameter	Value	Units
Input 1	Drive Enable	
Input 2	Fault Reset	
Input 3	Start Homing	
Input 4	Home Sensor	
Input 5	Start Indexing	
Input 6	Stop Indexing	
Input 7	Pause Index	
Input 8	Unassigned	

13. Close the Digital Inputs user window.

To use digital outputs to indicate an event has occurred:

1. Double-click the **Digital Outputs** branch. Use the drop-down arrows to change the output values as shown in the table below.



2. Close the Digital Outputs user window.
3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Apply 12-24V dc to input 3 (momentarily) to start the homing routine.
5. Apply 12-24V dc to input 4 (momentarily) to simulate a homing sensor. The drive goes into reverse to find the marker and completes the homing routine.
6. Double-click the **Digital Outputs** branch. Observe Digital Outputs status.

	Status	Value	Units
	Output 1 State		
	Output 2 State		
	Output 3 State		
	Output 4 State		
	Relay State		

- Output 1 is on because the drive is enabled.
 - Output 2 is on because the drive has been homed.
 - Output 3 is on because the motor is in position.
7. Apply 12-24V dc to input 5 and observe Digital Outputs 2 and 3 change states.
 8. Apply 12-24V dc to input 6 (momentarily) to stop the indexing move. Turn off input 5.
 9. Apply 12-24V dc to input 4 (momentarily again) to restart the indexing move. Turn off input 4.

- 10.** Apply 12-24V dc to input 7 to pause the indexing move. Remove the 12-24V dc and observe the index move continue.
- 11.** Close the user windows.
- 12.** Remove the 12-24V dc (Drive Enable) from input 1.

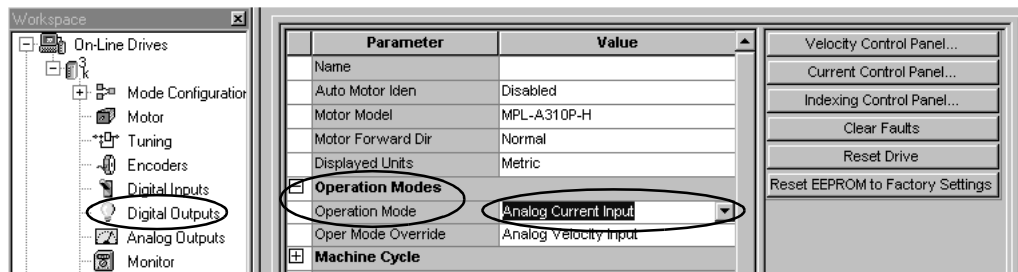
Configuring Your Ultra3000 Drive with Logix

In this section you will configure your Ultra3000 drive using Ultraware software, configure the Logix analog motion module using RSLogix™ 5000, and test/tune your axis.

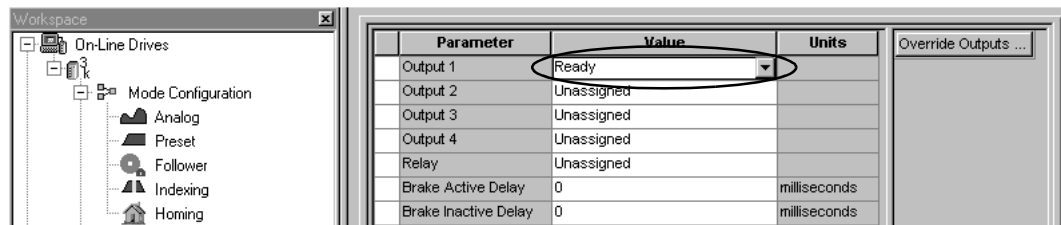
Configuring Your Ultra3000 Drive

To configure your Ultra3000 drive:

1. Apply power to your Ultra3000 drive (refer to the section *Applying Power To Your Ultra3000 Drive*).
2. Start your Ultraware software and ensure your Ultra3000 drive is detected (refer to the section *Detecting Your Ultra3000 Drive*).
3. Select a motor (refer to the section *Selecting a Motor*).
4. Expand **Operation Modes** in the Drive properties window.
5. Select **Analog Current Input** as the operation mode (as indicated in the window below).



6. Double-click on **Digital Outputs**. The Digital Output properties window opens.



7. Select **Ready** as the value of Output 1.

Configuring Your Logix Analog Motion Module

This procedure assumes that you have finished configuring your Ultra3000 drive.

For greater detail on the RSLogix 5000 software as it applies to ControlLogix and SoftLogix modules, refer to the table below for the appropriate publication.

For:	Refer to this Document	Publication Number:
Detailed information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Detailed information on configuring and troubleshooting your SoftLogix PCI card	<i>SoftLogix Motion Card Setup and Configuration Manual</i>	1784-UM003x-EN-P

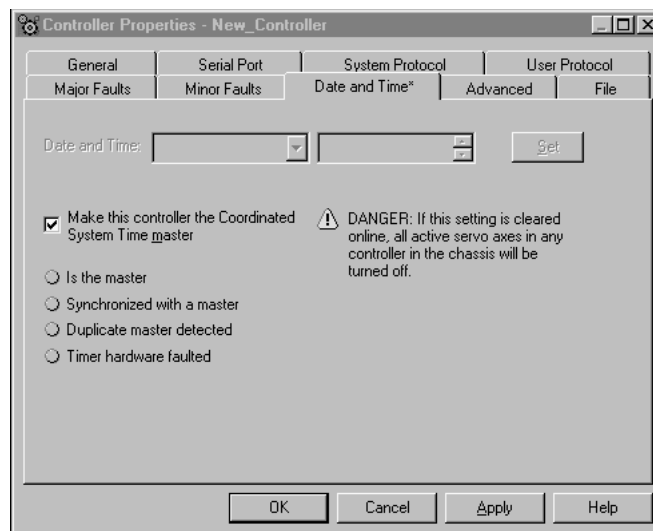
If you have already configured your Logix module using one of the setup and configuration manuals listed above, go directly to *Testing and Tuning Your Axis* (page 1-41). If not, go to *Configuring Your Logix Controller* beginning below.

Configuring Your Logix Controller

To configure your Logix controller:

1. Apply power to your Logix chassis/PC containing the analog motion module and open your RSLogix 5000 software.
2. Select **New** in the File menu. The New Controller window opens.
 - Select controller type
 - Name the file
 - Select the ControlLogix chassis size
 - Select the ControlLogix processor slot
3. Select **OK**.
4. Select **Controller Properties** in the edit menu. The Controller Properties window opens.

5. Select the **Date and Time** tab. The following window opens.



6. Check the box **Make this controller the Coordinated System Time master**.
7. Select **OK**.

Configuring Your Logix Module

To configure your Logix module:

1. Right-click on I/O Configuration in the explorer window and select **New Module**. The Select Module Type window opens.
2. Select **1756-M02AE** or **1784-PM02AE** as appropriate for your actual hardware configuration.

3. Select **OK**. The Module Properties wizard opens.

Module Properties - Local (1756-M02AE 12.1)

Type: 1756-M02AE 2 Axis Analog/Encoder Servo

Vendor: Allen-Bradley

Name: IM_1 Slot: 4

Description:

Revision: 12 Electronic Keying: Disable Keying

Buttons: Cancel, < Back, Next >, Finish >>, Help

- Name the module
 - Select the slot where your module resides
 - Select an Electronic Keying option.
4. Select **Next** until the following window opens.

Module Properties - Local:9 (1756-M02AE 5.1)

Servo Update Period: 200 us

Associated Axes:

Channel 0: <none> Channel 1: <none> New Axis...

Buttons: Cancel, < Back, Next >, Finish >>, Help

5. Select the **New Axis** button. The New Tag window opens.

New Tag

Name:

Description:

Tag Type: ☒ Base ☐ Alias ☐ Produced ☐ Consumed

Data Type: AXIS_SERVO Configure...

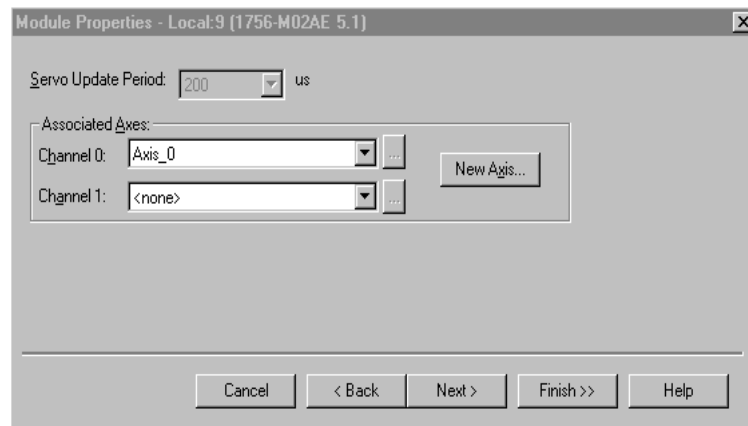
Scope: Ultra3000_Integration(controller)

Style:

Buttons: OK, Cancel, Help

- Name the axis
- Select **AXIS_SERVO** as the Data Type

6. Select **OK**.
7. Assign your axis to a node address (as shown in the window below).

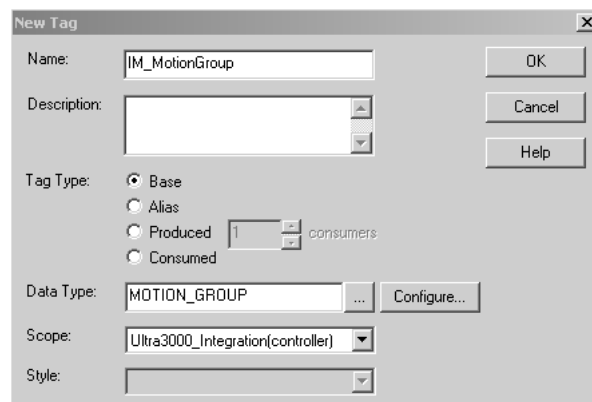


8. Select **Finish**.

Configuring the Motion Group

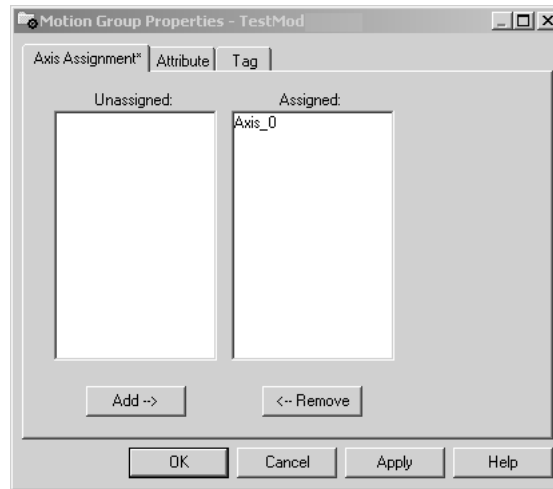
To configure the motion group:

1. Right-click Motion Groups in the explorer window and select **New Motion Group**. The New Tag window opens.



2. Name the new motion group.
3. Select **OK**. New group appears under Motion Group folder.

- Right-click on the new motion group and select **Properties**. The Motion Group Properties window opens.

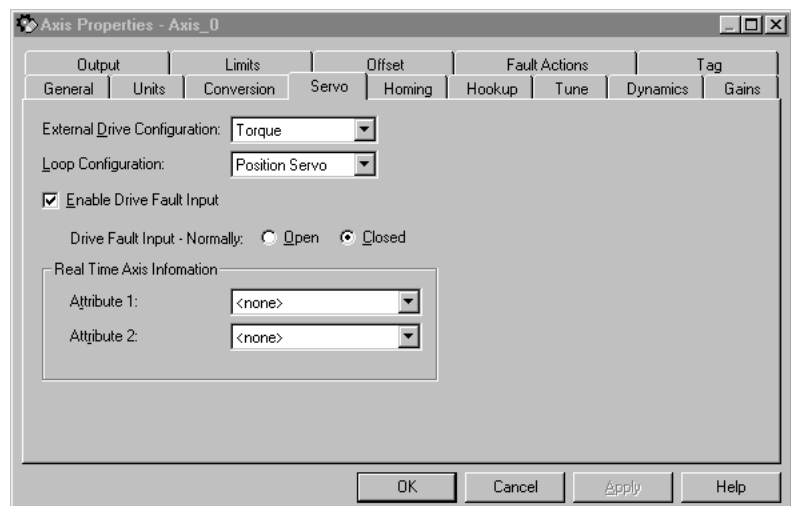


- Select the **Axis Assignment** tab and move your axis (created earlier) from *Unassigned* to *Assigned*.
- Select the **Attribute** tab and edit the default values as appropriate for your application.
- Select **OK**.

Configuring Axis Properties

To configure axis properties:

- Right-click on an axis in the explorer window and select **Properties**. The Axis Properties window opens.
- Select the **Servo** tab.



3. Select **Torque** as the External Drive Configuration.
4. Check the box **Enable Drive Fault Input** and select **Normally Closed**.
5. Select the **Units** tab and edit default values as appropriate for your application.
6. Select the **Conversion** tab and edit default values as appropriate for your application.
7. Select **OK**.
8. Verify your Logix program and save the file.

Downloading Your Program

After completing the Logix configuration you must download your program to the Logix processor.

Testing and Tuning Your Axis

This procedure assumes that you have configured your Ultra3000 and the analog motion module.

IMPORTANT

Before proceeding with testing and tuning your axis, verify that the seven-segment status LEDs are actively cycling in a full circle.

For greater detail on the RSLogix 5000 software as it applies to ControlLogix and SoftLogix modules, refer to the table below for the appropriate publication.

For:	Refer to this Document	Publication Number:
Detailed information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Detailed information on configuring and troubleshooting your SoftLogix PCI card	<i>SoftLogix Motion Card Setup and Configuration Manual</i>	1784-UM003x-EN-P

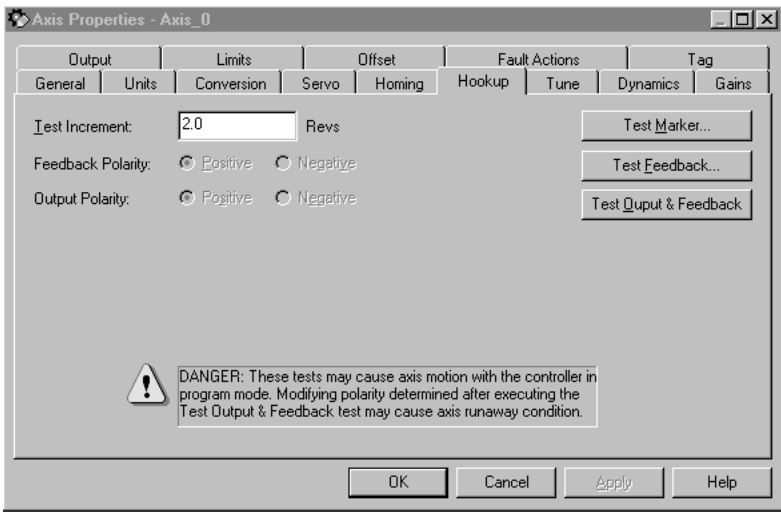
If you have already tested and tuned your axis using one of the setup and configuration manuals listed above, you are finished commissioning your drive. If not, go to *Testing Your Axis* beginning below.

Testing Your Axis

To test your axis:

1. Remove the load from your axis.
2. Right-click on the axis in your Motion Group folder in the explorer window and select **Axis Properties**. The Axis Properties window opens.

3. Select the **Hookup** tab.



4. Select **2.0** as the number of revolutions for the test (or another number more appropriate for your application).

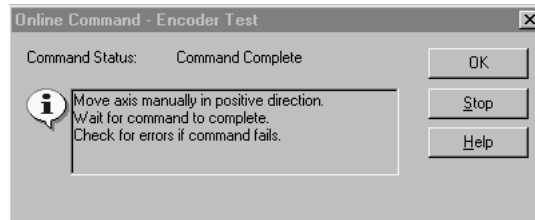
This Test:	Performs this Test:
Test Marker	Verifies marker detection capability as you rotate the motor shaft.
Test Feedback	Verifies feedback connections are wired correctly as you rotate the motor shaft.
Test Command & Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate. Also, allows you to define polarity.

5. Apply Drive Enable (Input 1) signal (CN1-31) for the axis you are testing.

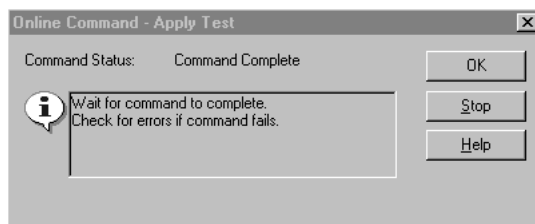
ATTENTION

To avoid personal injury or damage to equipment, apply 24V Drive Enable signal (CN1-31) only to the axis you are testing.

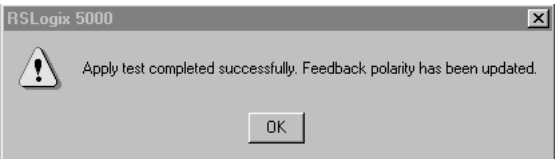
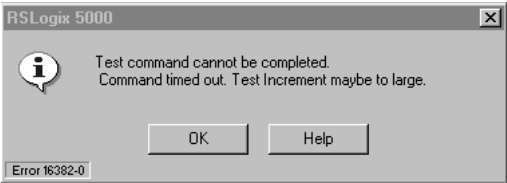
6. Select the **Test** (Marker/Feedback/Command & Feedback) button to verify connections. The Online Command window opens. Follow the on-screen test instructions. When the test completes, the Command Status changes from *Executing* to *Command Complete*



7. Select **OK**.
8. The Online Command - Apply Test window opens (Feedback and Command & Feedback tests only). When the test completes, the Command Status changes from *Executing* to *Command Complete*.



9. Select **OK**.

If:	Then:
<p>Your test completes successfully, this window appears:</p> 	<ol style="list-style-type: none"> 1. Select OK. 2. Remove Drive Enable signal (CN1-31). 3. Go to <i>Tuning Your Axis</i>.
<p>Your test failed, this window appears:</p> 	<ol style="list-style-type: none"> 1. Select OK. 2. Verify that the main three-phase bus power is up. 3. Verify that the Drive Enable signal (CN1-31) is applied to the axis you are testing. 4. Verify conversion constant entered in the Conversion tab. 5. Return to step 6 and run the test again.

Tuning Your Axis

To tune your axis:

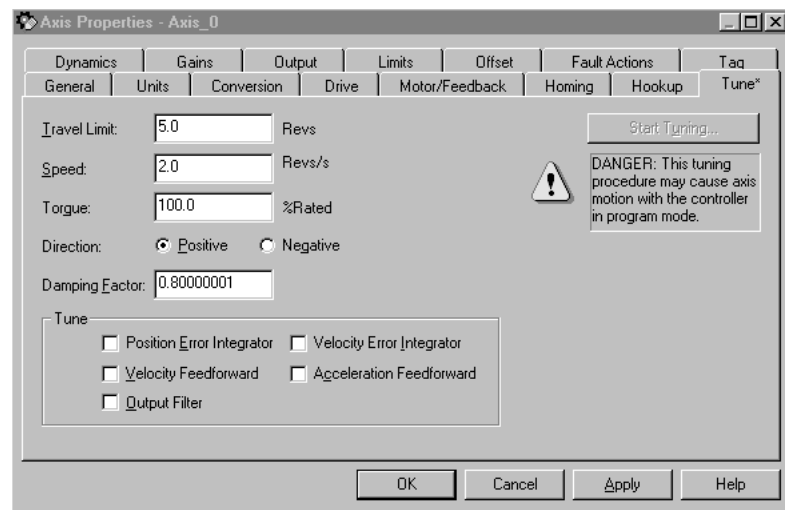
1. Verify the load is still removed from the axis being tuned.

ATTENTION



To reduce the possibility of unpredictable motor response, tune your motor with the load removed first, then re-attach the load and perform the tuning procedure again to provide an accurate operational response.

2. Select the **Tune** tab.



3. Enter values for Travel Limit and Speed. In this example, Travel Limit = 5 and Speed = 2.

Note: Actual value of programmed units depend on your application. For more information, contact Allen-Bradley technical support.

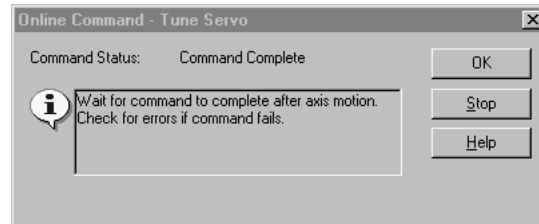
4. Check **Tune** boxes as appropriate for your application.
5. Apply Drive Enable (Input 1) signal (CN1-31) for the axis you are tuning.

ATTENTION

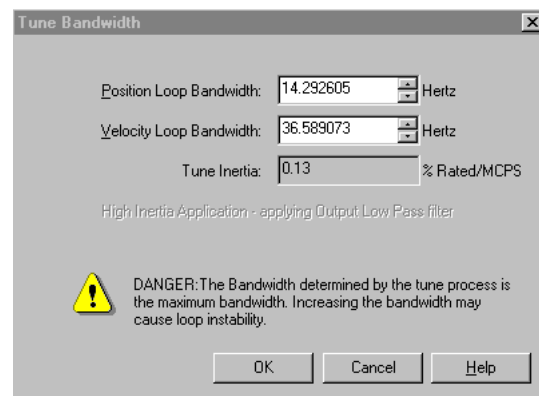


To avoid personal injury or damage to equipment, apply 24V Drive Enable signal (CN1-31) only to the axis you are tuning.

6. Select the **Start Tuning** button to auto-tune your axis. The Online Command - Tune Servo window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



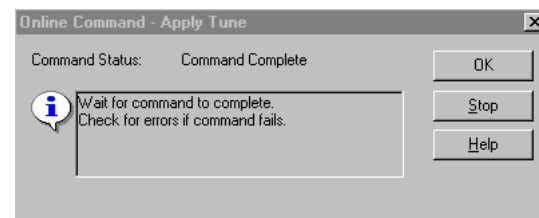
7. Select **OK**. The Tune Bandwidth window opens.



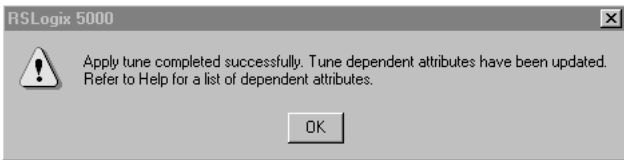
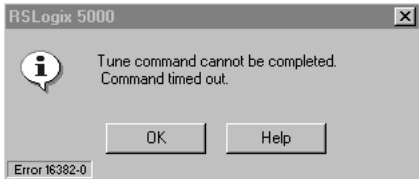
Note: Actual bandwidth values (Hz) depend on your application and may require adjustment once motor and load are connected.

Record your bandwidth data for future reference.

8. Select **OK**.
9. The Online Command - Apply Tune window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



10. Select OK.

If:	Then:
<p>Your test completes successfully, this window appears:</p> 	<ol style="list-style-type: none">1. Select OK.2. Remove Drive Enable (Input 1) signal (CN1-31) applied earlier.3. You are finished tuning your Ultra3000.
<p>Your test failed, this window appears:</p> 	<ol style="list-style-type: none">1. Select OK.2. Make an adjustment to motor velocity.3. Refer to appropriate Logix motion module setup and configuration manual for more information.4. Return to step 6 and run the test again.

Configuring Your Ultra3000 with SERCOS interface Drive

The procedures in this section apply to Ultra3000-SE drives (2098-DSD-xxx-SE and -HVxxx-SE) and describe how to:

- Configure your Ultra3000-SE drive
- Configure your SERCOS interface module using RSLogix 5000 software
- Download your program to your Logix controller
- Apply power to your Ultra3000-SE drive
- Test and tune your motor using RSLogix 5000 software.

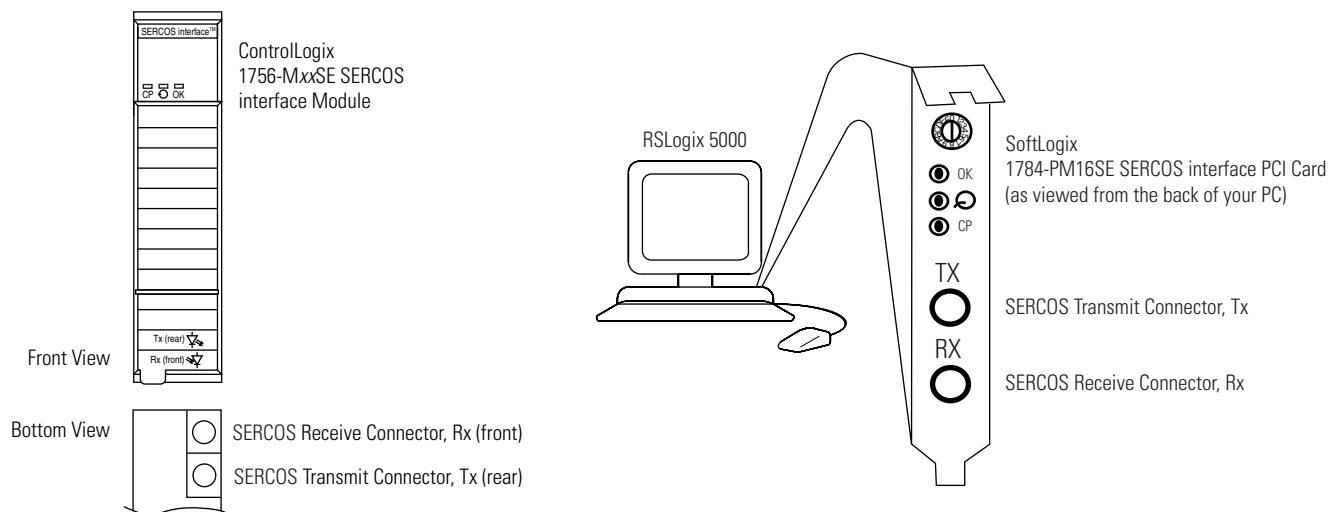
These procedures assume you have connected the fiber-optic cables between your Ultra3000-SE drive and the SERCOS interface module.

Front Panel Connections

This section provides front panel connection information for your Ultra3000-SE and the ControlLogix SERCOS interface module or SoftLogix SERCOS PCI card.

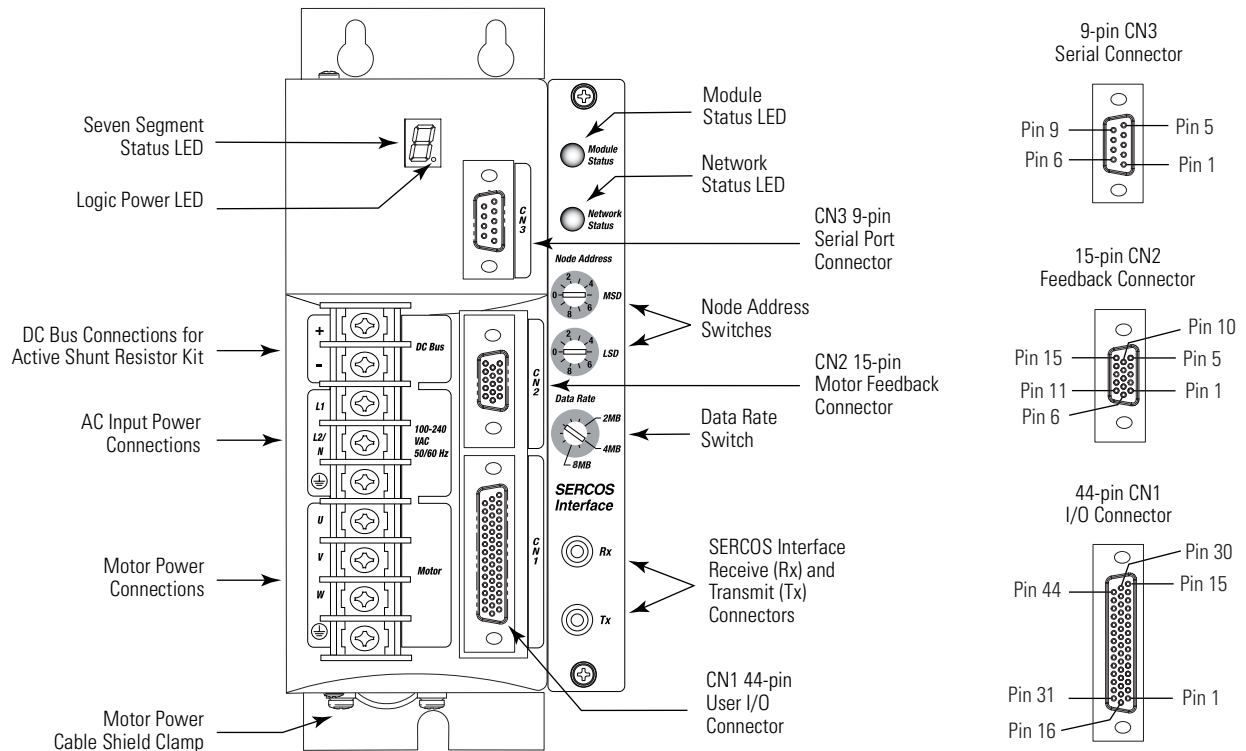
Use the figure below to locate the SERCOS ring LEDs and fiber-optic cable connections on your SERCOS interface module.

Figure 1.7
ControlLogix and SoftLogix SERCOS Connector Locations



Use the figure below to locate the front panel connections on the Ultra3000-SE 230V drives (500W, 1 kW, and 2 kW).

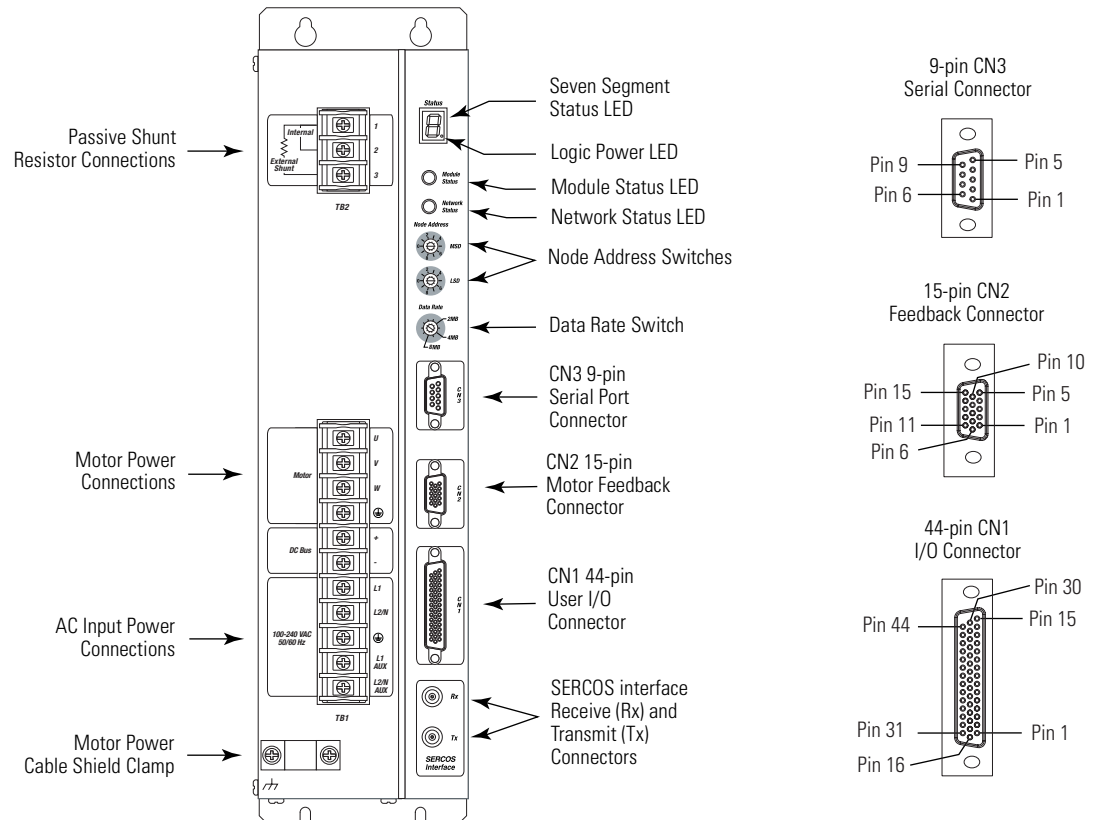
Figure 1.8
Ultra3000-SE Front Panel Connections for 2098-DSD-005-SE, -010-SE, and -020-SE



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000-SE 230V drive (3 kW).

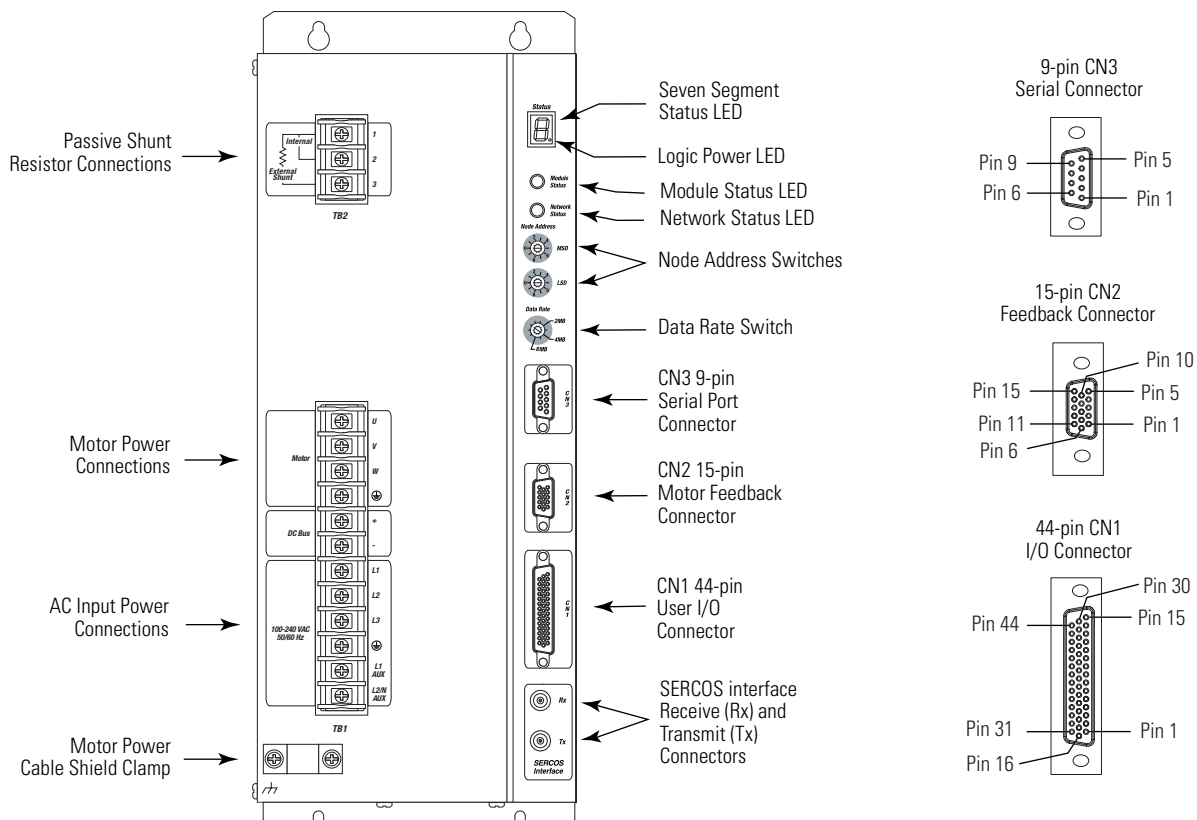
Figure 1.9
Ultra3000-SE Front Panel Connections for 2098-DSD-030-SE



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000-SE 230V drives (7.5 and 15 kW).

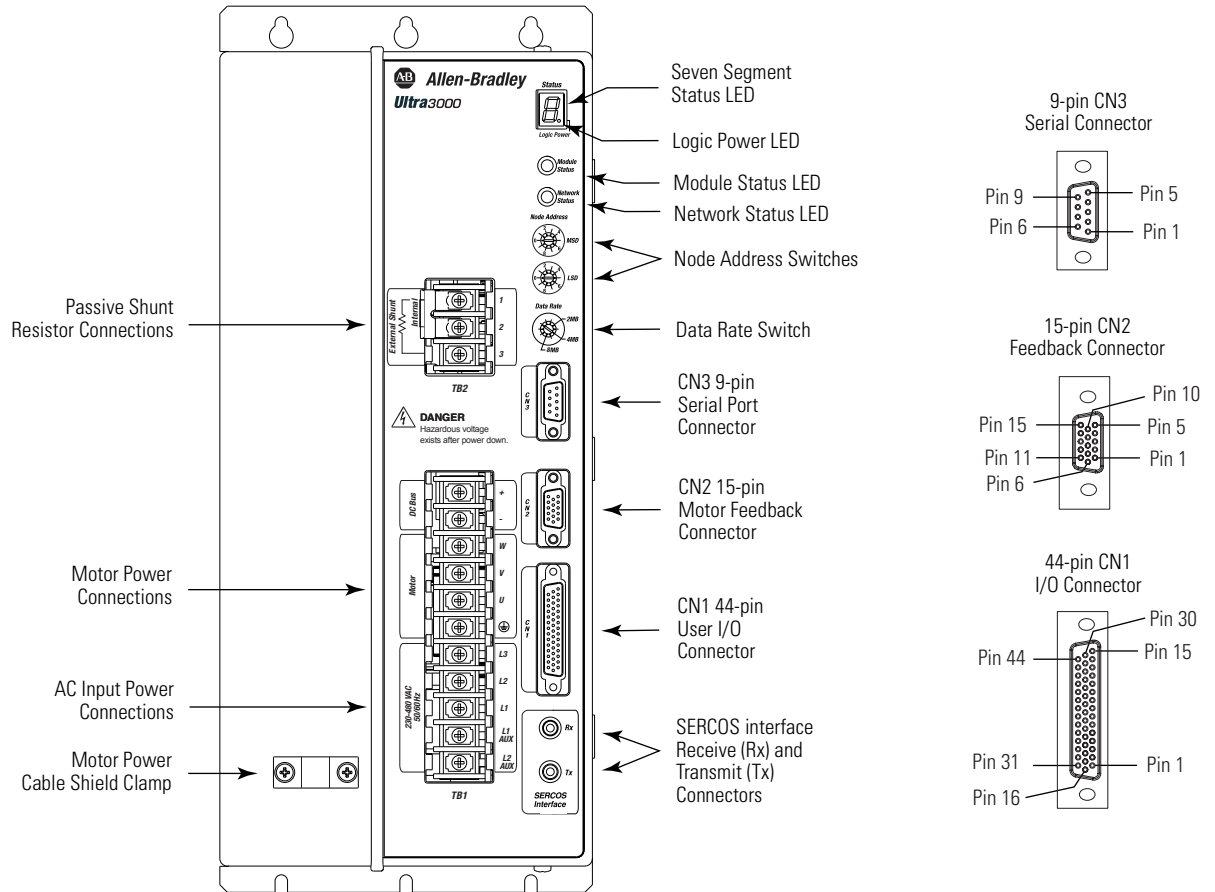
Figure 1.10
Ultra3000-SE Front Panel Connections for 2098-DSD-075-SE and -150-SE



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000-SE 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.11
Ultra3000-SE Front Panel Connections for 2098-DSD-HVxxx-SE



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Configuring Your Ultra3000 Drive

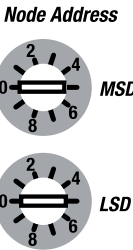
Use the following procedures to configure your Ultra3000-SE drive (2098-DSD-xxx-SE and -HVxxx-SE).

To configure your Ultra3000-SE drive:

- 1. Verify that there is no power applied to the drive, and the SERCOS fiber-optic cables are correctly plugged into the Tx and Rx connectors. To verify your fiber-optic cable connections, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).
- 2. Set the node address for each drive in your system. Valid node addresses are 01-99. The MSD rotary switch sets the most significant digit and the LSD rotary switch sets the least significant digit. Refer to figures 1.8-1.11 for the location of the switches. Refer to the table below for examples.

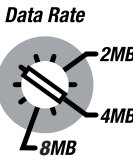
For this Node Address:	Set the MSD switch to:	Set the LSD switch to:
10	1	0
11	1	1
12	1	2

Use the MSD and LSD rotary switches on the SERCOS panel of the drive to set node addresses. Refer to Figure 1.13 for node address setting examples.



- 3. Set the data rate. Valid data rates are 2M, 4M, and 8M baud. Refer to figures 1.8-1.11 for the location of the switch.

Use the Data Rate rotary switch on the SERCOS panel of the drive to set the data rate.



Refer to Figure 1.12 for an example of the fiber-optic connections between the Ultra3000-SE drive(s) and the SoftLogix PCI card. Although Figure 1.12 only illustrates the SERCOS fiber-optic ring with the SoftLogix PCI card, node addressing for SoftLogix is done the same way as shown in the node addressing example with ControlLogix (Figure 1.13).

Figure 1.12
Fiber-Optic Ring Connection

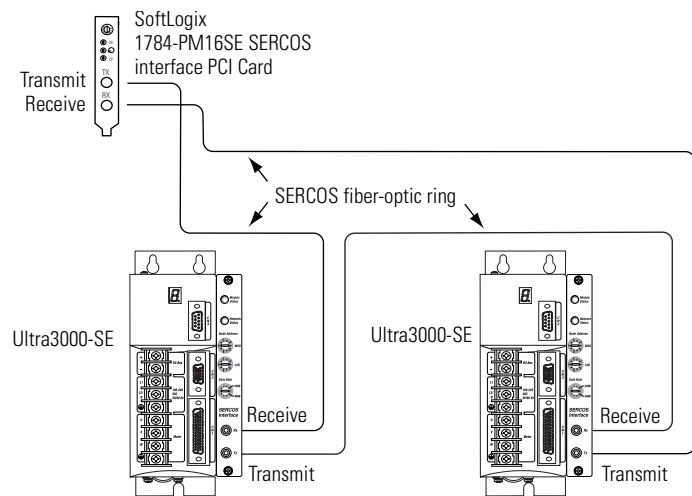
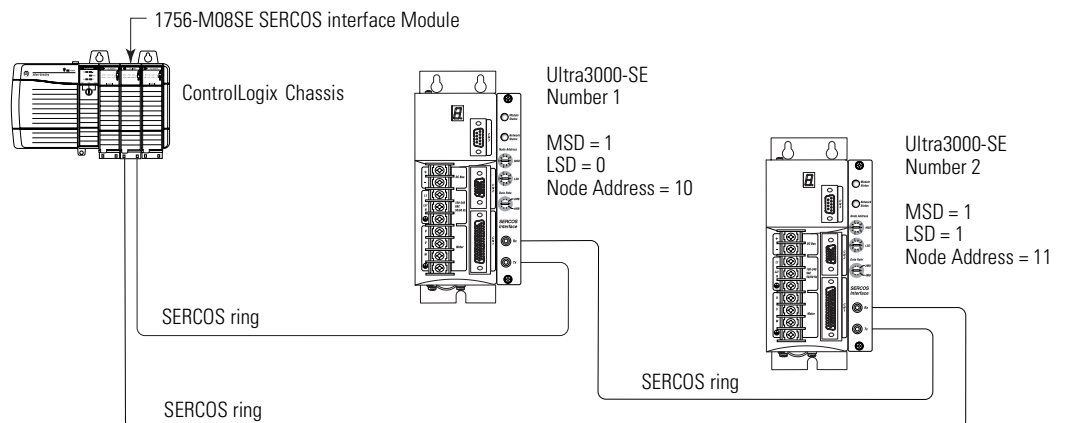


Figure 1.13
Ultra3000-SE Node Addresses



4. Verify CN1-31 (Input 1) is configured as Drive Enable and tied to 12-24V dc.
5. If using Overtravel inputs, verify that 12-24V dc is tied to CN1-37 and -38.

IMPORTANT

Without CN1-37 and -38 inputs applied, the drive/system will fault.

Configuring Your Logix SERCOS interface Module

This procedure assumes that you have configured the Ultra3000-SE baud rate and optical power switches.

For greater detail on the RSLogix 5000 software as it applies to ControlLogix and SoftLogix modules, refer to the table below for the appropriate publication.

For:	Refer to this Document	Publication Number:
Detailed information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Detailed information on configuring and troubleshooting your SoftLogix PCI card	<i>SoftLogix Motion Card Setup and Configuration Manual</i>	1784-UM003x-EN-P

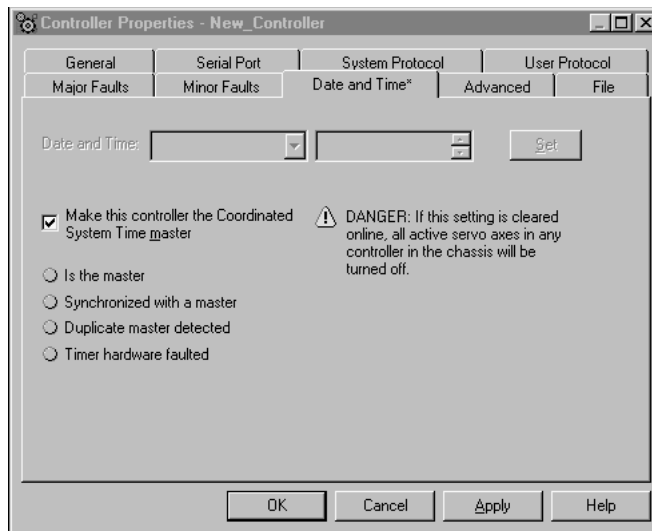
If you have already configured your Logix controller using one of the setup and configuration manuals listed above, go directly to *Applying Power To Your Ultra3000 with SERCOS* (page 1-61). If not, go to *Configuring Your Logix Controller* beginning below.

Configuring Your Logix Controller

To configure your Logix controller:

1. Apply power to your Logix chassis/PC containing the SERCOS interface module and open your RSLogix 5000 software.
2. Select **New** in the File menu. The New Controller window opens.
 - Select controller type
 - Name the file
 - Select the ControlLogix chassis size
 - Select the ControlLogix processor slot
3. Select **OK**.
4. Select **Controller Properties** in the edit menu. The Controller Properties window opens.

5. Select the **Date and Time** tab. The following window opens.



6. Check the box **Make this controller the Coordinated System Time master**.

IMPORTANT

Only one ControlLogix processor can be assigned as the Coordinated System Time master.

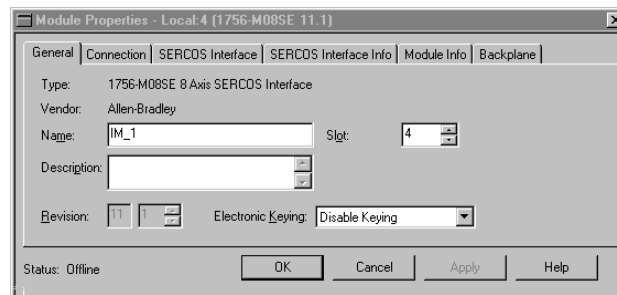
7. Select **OK**.

Configuring Your Logix Module

To configure your Logix module:

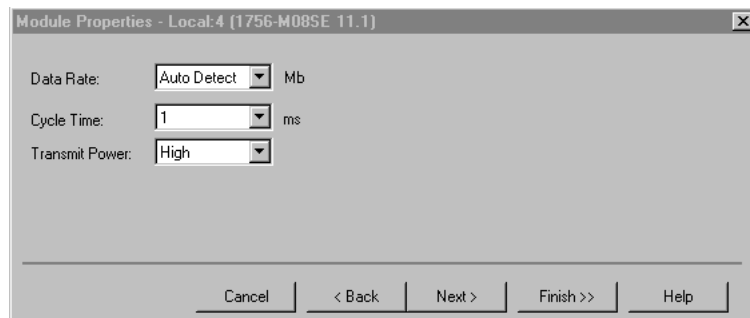
1. Right-click on I/O Configuration in the explorer window and select **New Module**. The Select Module Type window opens.
2. Select **1756-MxxSE** or **1784-PM16SE** as appropriate for your actual hardware configuration.

3. Select **OK**. The Module Properties wizard opens.



- Name the module
- Select the slot where your module resides
- Select an Electronic Keying option.

4. Select **Next** until the following window opens.



5. Select **Data Rate**, **Cycle Time**, and **Optical Power** settings.

- Ensure the Data Rate setting matches Data Rate (baud rate) switch as set on the Ultra3000-SE drive, or use the Auto Detect setting.
- Set the Cycle Time according to the table below.

Logix SERCOS Module	Ultra3000-SE Drive Series	Data Rate Mbit/s	SERCOS Ring Cycle Time ms	Number of Axes
1756-M08SE (Series A)	A or B	4	0.5	N/A
			1.0	up to 4
			2.0	up to 8
1756-M08SE (Series B)	B only	8	0.5	N/A
			1.0	up to 8
			2.0	
1756-M16SE or 1784-PM16SE	A or B	4	0.5	N/A
			1.0	up to 4
			2.0	up to 8
		No support for 9-16 axes		
	B only	8	0.5	N/A
			1.0	up to 8
			2.0	up to 16

- Set the Transmit Power setting to High.

6. Select **Finish**. Your new SERCOS module appears under the I/O Configuration folder in the explorer window.

Configuring Your Ultra3000-SE

To configure your Ultra3000-SE drive:

1. Right-click on your new module and select **New Module**. The Select Module Type window opens.
2. Select **2098-DSD-xxx-SE** or **-HVxxx-SE** drive as appropriate for your actual hardware configuration.

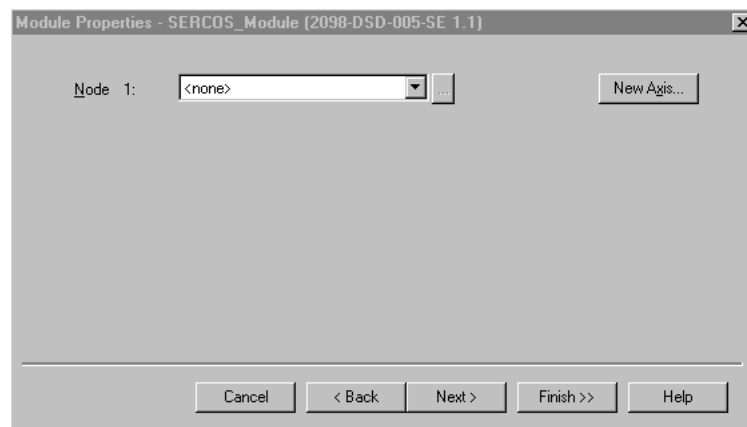
3. Select **OK**. The Module Properties window opens.

- Name the module
- Set the Base Node address

Note: Set the node address in the software to match the node address setting on the drive. Refer to *Configuring Your Ultra3000 Drive*, step 2, on page 1-52.

- Electronic Keying option

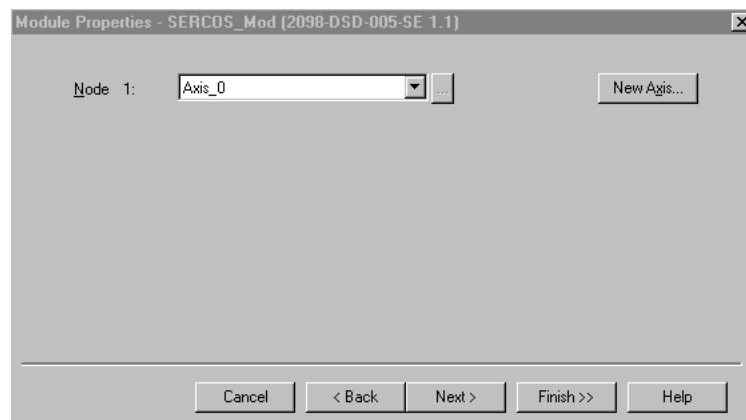
4. Select **Next** until the following window appears.



5. Select the **New Axis** button. The New Tag window opens.

- Name the axis
- Select **AXIS_SERVO_DRIVE** as the Data Type

6. Assign your axis to a node address (as shown in the window below).



7. Select **Next. Bus Regulator Catalog Number** (shunt option) does not apply. Select **<none>**.

ATTENTION



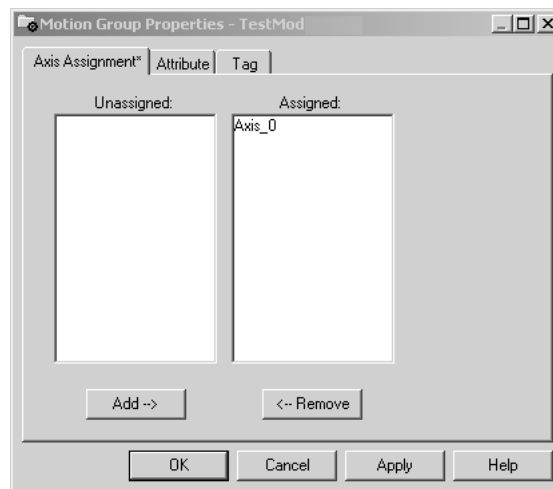
To avoid damage to your external shunt module, verify that the proper 230V or 460V fuse is installed prior to applying power. Refer to *Passive Shunt Modules Installation Instructions* (publication 2090-IN004x-EN-P) for more information.

8. Select **Finish**.

Configuring the Motion Group

To configure the motion group:

1. Right-click Motion Groups in the explorer window and select **New Motion Group**. The New Tag window opens.
2. Name new motion group.
3. Select **OK**. New group appears under Motion Group folder.
4. Right-click on the new motion group and select **Properties**. The Motion Group Properties window opens.

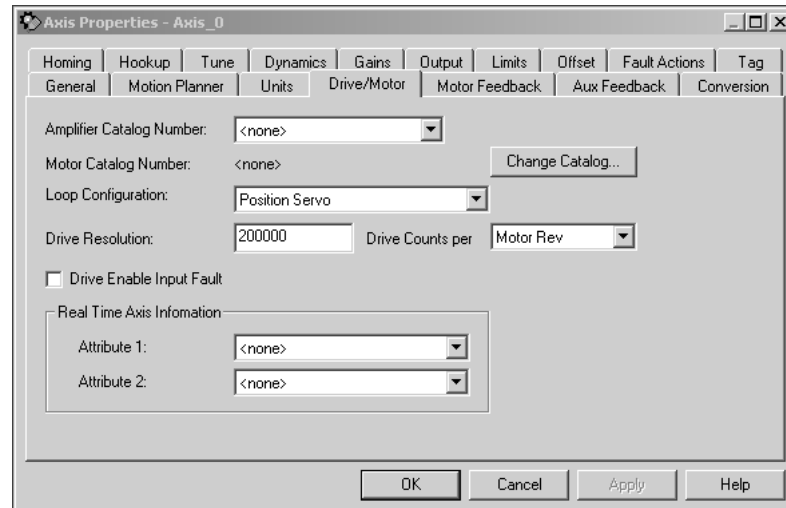


5. Select the **Axis Assignment** tab and move your axis (created earlier) from *Unassigned* to *Assigned*.
6. Select the **Attribute** tab and edit the default values as appropriate for your application.
7. Select **Ok**.

Configuring Axis Properties

To configure axis properties:

8. Right-click on an axis in the explorer window and select **Axis Properties**. The Axis Properties window opens.

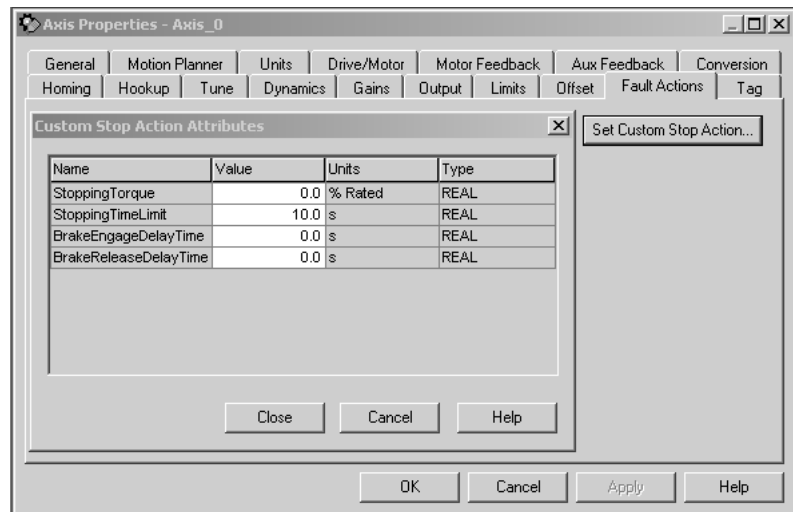


9. Select the **Drive/Motor** tab.
 - Set the Ultra3000 Amplifier (2098-DSD-xxx-SE or -HVxxx-SE)
 - Set the Motor Catalog Number
 - Set Loop Configuration to Position Servo

Note: For amplifier and motor catalog numbers refer to the amplifier and motor name plate.

10. Select the **Motor Feedback** tab and verify the Feedback Type shown is appropriate for your actual hardware configuration.
11. Select the **Units** tab and edit default values as appropriate for your application.
12. Select the **Conversion** tab and edit default values as appropriate for your application.

13. Select the **Fault Actions** tab and click on the Set Custom Stop Action... tab. The Custom Stop Action Attributes window opens.



- Set the Brake Engage Delay Time
- Set the Brake Release Delay Time
- Select **Close**

14. Select **OK**.

15. Verify your Logix program and save the file.

Downloading Your Program

After completing the Logix configuration you must download your program to the Logix processor.

Applying Power To Your Ultra3000 with SERCOS

This procedure assumes you have configured your Ultra3000-SE drive and your SERCOS interface module.

ATTENTION




High voltage exists in AC line filters. The filter must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels. Failure to observe this precaution could result in personal injury.

To apply power to your Ultra3000-SE drive:

1.
- Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.

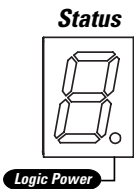
ATTENTION



To avoid damage to the drive due to improper sequencing of input power and the Drive Enable signal, do not issue the Drive Enable command from RSLogix 5000 without first applying input power.

2.
- Apply input power to the Ultra3000-SE and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.14
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	1. Check your input power connections. 2. Repeat main step 2.

3.
- Observe the front panel seven segment Status LED display as shown in Figure 1.14.

If the Status LED display on your:	Is:	Then:
2098-DSD-xxx-SE or -HVxxx-SE drive	Displaying a fixed 4	The drive is ready. Go to main step 4.
	Flashing an E followed by two numbers	Go to <i>Error Codes</i> on page 2-2.

4.
- Observe the module status LED.

If the module status LED:	Then:
Is steady green	The drive is enabled. Go to step 5.
Flashes green	The drive is disabled. Go to step 5.
Is not steady green/ not flashing green	Go to <i>SERCOS Module Status LED</i> on page 2-8.

5. Observe the network status LED.

If the network status LED:	Then:
Flashes green	Establishing communication with network (wait for steady green).
Illuminates steady green	Communication is ready. Go to step 6.
Is not steady green/ not flashing green	Go to <i>DeviceNet Network Status LED</i> on page 2-12.

6. Observe the three SERCOS LEDs on the SERCOS module.

If the three SERCOS LEDs:	Then:
Flash green and red	Establishing communication (wait for steady green on all three LEDs).
Illuminates steady green	Communication ready. Go to <i>Testing and Tuning Your Axis</i> .
Is not flashing green and red/ not steady green	Go to the appropriate Logix motion module setup and configuration manual for specific instructions and troubleshooting.

Testing and Tuning Your Axis

This procedure assumes that you have configured your Ultra3000-SE, your SERCOS interface module, and applied power to the system.

IMPORTANT

Before proceeding with testing and tuning your axis, verify that the Ultra3000-SE status LEDs are as described in the table below.

Status LED:	Must be:	Status:
Seven Segment	Displaying a fixed 4	The drive is ready.
Module	Is steady green or Flashes green	The drive is enabled.
Network	Illuminates steady green	SERCOS Communication is ready.

For greater detail on the RSLogix 5000 software as it applies to ControlLogix and SoftLogix modules, refer to the table below for the appropriate publication.

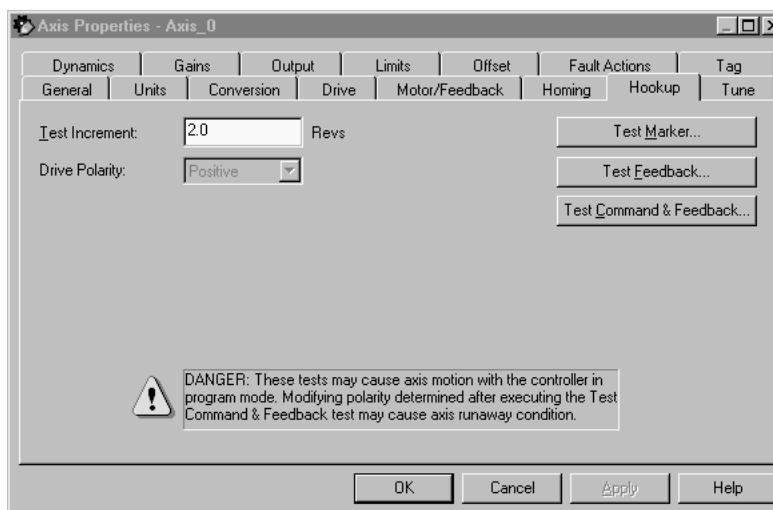
For:	Refer to this Document	Publication Number:
Detailed information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Detailed information on configuring and troubleshooting your SoftLogix PCI card	<i>SoftLogix Motion Card Setup and Configuration Manual</i>	1784-UM003x-EN-P

If you have already tested and tuned your axis using one of the setup and configuration manuals listed above, you are finished commissioning your drive. If not, go to *Testing Your Axis* beginning below.

Testing Your Axis

To test your axis:

1. Verify the load was removed from your motor(s).
2. Right-click on the axis in your Motion Group folder in the explorer window and select **Axis Properties**. The Axis Properties window opens.
3. Select the **Hookup** tab.



4. Select **2.0** as the number of revolutions for the test (or another number more appropriate for your application).

This Test:	Performs this Test:
Test Marker	Verifies marker detection capability as you rotate the motor shaft.
Test Feedback	Verifies feedback connections are wired correctly as you rotate the motor shaft.
Test Command & Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate. Also, allows you to define polarity.

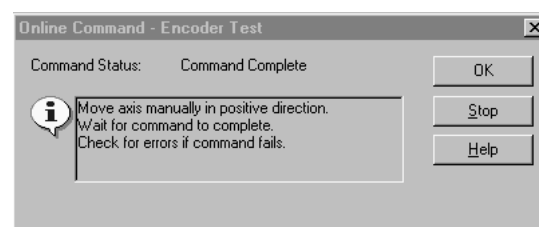
5. Apply Drive Enable (Input 1) signal (CN1-31) for the axis you are testing.

ATTENTION



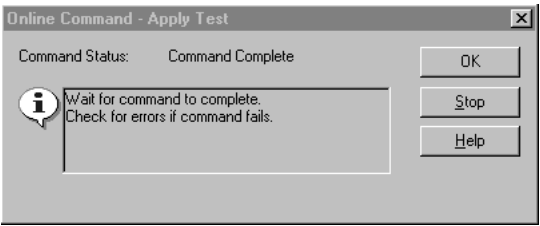
To avoid personal injury or damage to equipment, apply 24V Drive Enable signal (CN1-31) only to the axis you are testing.

6. Select the **Test** (Marker/Feedback/Command & Feedback) button to verify connections. The Online Command window opens. Follow the on-screen test instructions. When the test completes, the Command Status changes from *Executing* to *Command Complete*.

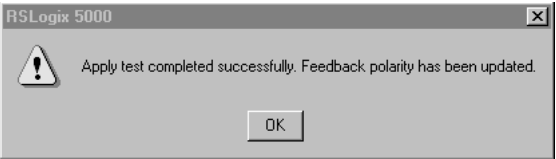
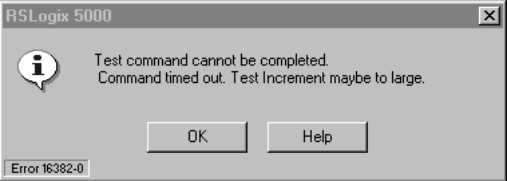


7. Select **OK**.

8. The Online Command - Apply Test window opens (Feedback and Command & Feedback tests only). When the test completes, the Command Status changes from *Executing* to *Command Complete*.



9. Select **OK**.

If:	Then:
<p>Your test completes successfully, this window appears:</p> 	<ol style="list-style-type: none">1. Select OK.2. Remove Drive Enable signal (CN1-31).3. Go to <i>Tuning Your Axis</i>.
<p>Your test failed, this widow appears:</p> 	<ol style="list-style-type: none">1. Select OK.2. Verify that the main three-phase bus power is up.3. Verify that the Drive Enable signal (CN1-31) is applied to the axis you are testing.4. Verify conversion constant entered in the Conversion tab.5. Return to main step 6 and run the test again.

Tuning Your Axis

To tune your axis:

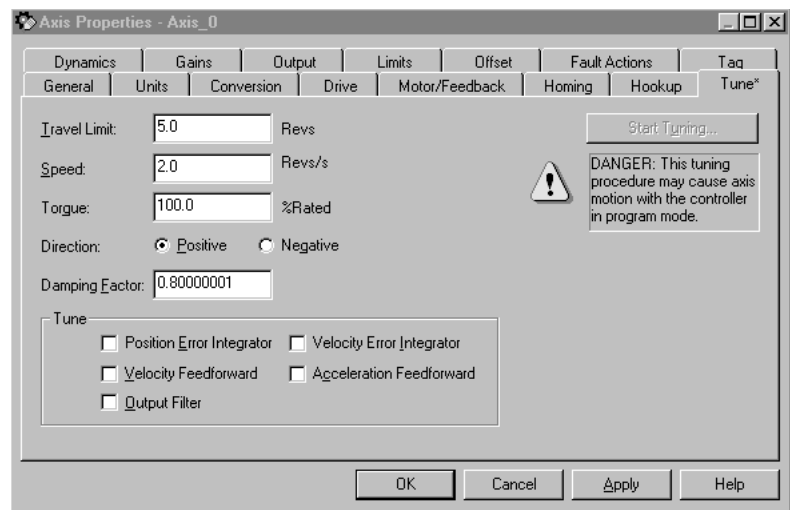
1. Verify the load is still removed from the axis being tuned.

ATTENTION



To reduce the possibility of unpredictable motor response, tune your motor with the load removed first, then re-attach the load and perform the tuning procedure again to provide an accurate operational response.

2. Select the **Tune** tab.



3. Enter values for Travel Limit and Speed. In this example, Travel Limit = 5 and Speed = 2.

Note: Actual value of programmed units depend on your application. For more information, contact Allen-Bradley technical support.

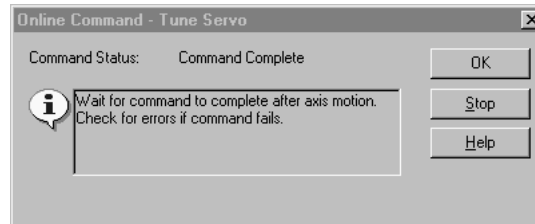
4. Check **Tune** boxes as appropriate for your application.
5. Apply Drive Enable (Input 1) signal (CN1-31) for the axis you are tuning.

ATTENTION

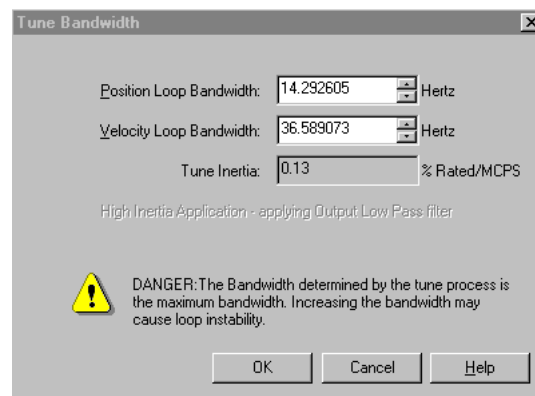


To avoid personal injury or damage to equipment, apply 24V Drive Enable signal (CN1-31) only to the axis you are tuning.

6. Select the **Start Tuning** button to auto-tune your axis. The Online Command - Tune Servo window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



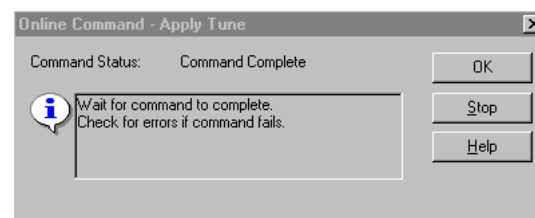
7. Select **OK**. The Tune Bandwidth window opens.



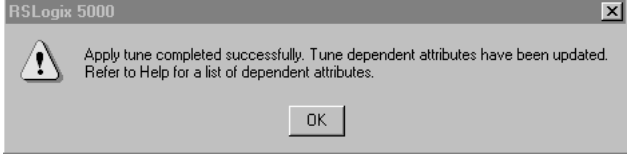
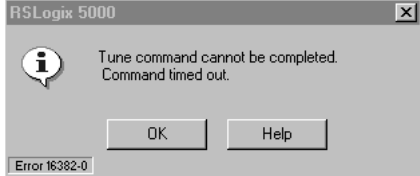
Note: Actual bandwidth values (Hz) depend on your application and may require adjustment once motor and load are connected.

Record your bandwidth data for future reference.

8. Select **OK**.
9. The Online Command - Apply Tune window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



10. Select **OK**.

If:	Then:
<p>Your test completes successfully, this window appears:</p> 	<ol style="list-style-type: none"> 1. Select OK. 2. Remove Drive Enable (Input 1) signal (CN1-31) applied earlier. 3. You are finished tuning your axis.
<p>Your test failed, this window appears:</p> 	<ol style="list-style-type: none"> 1. Select OK. 2. Make an adjustment to motor velocity. 3. Refer to appropriate Logix motion module setup and configuration manual for more information. 4. Return to step 6 and run the test again.

Configuring Your Ultra3000 with DeviceNet Drive

The procedures in this section apply to Ultra3000-DN drives (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, and -HVxxxX-DN) and describe how to:

- Configure your Ultra3000-DN drive
- Apply power to your Ultra3000-DN drive

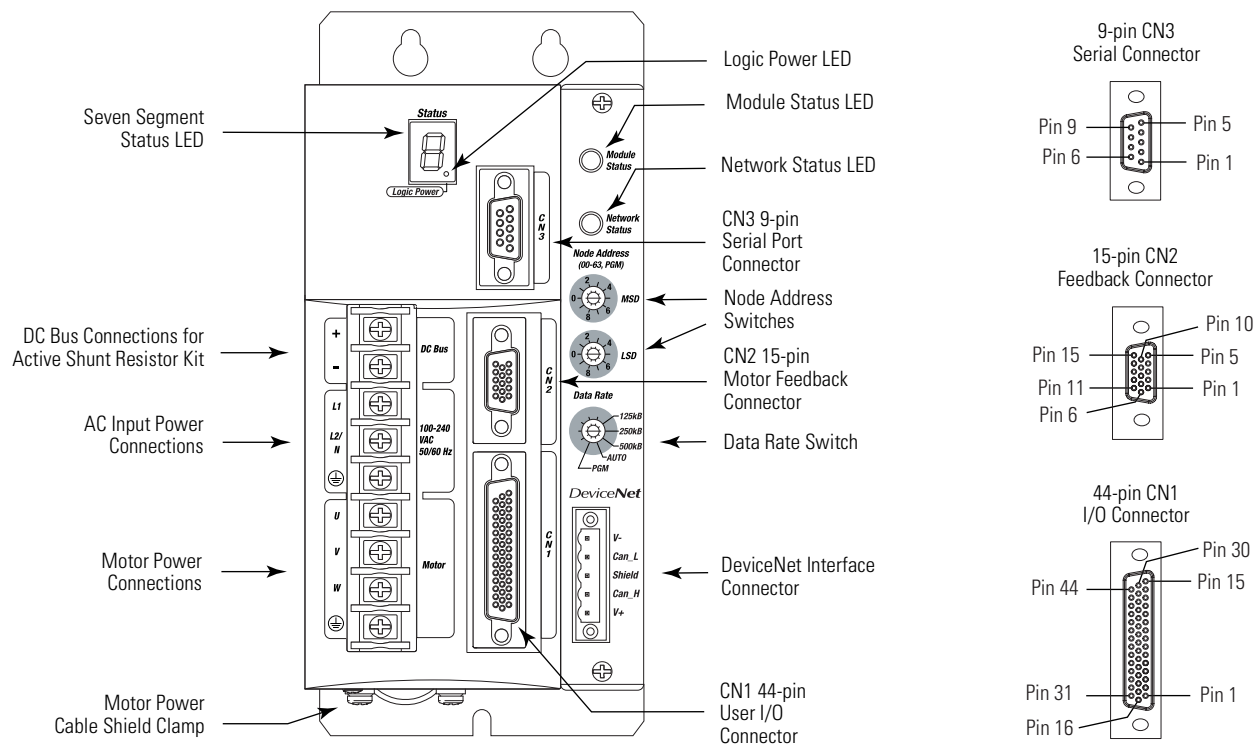
These procedures assume you have completed wiring the DeviceNet interface connector on your Ultra3000-DN drive.

Front Panel Connections

This section provides front panel connection information for your Ultra3000-DN drive.

Use the figure below to locate the front panel connections on the Ultra3000-DN 230V drives (500W, 1 kW, and 2 kW).

Figure 1.15
Ultra3000-DN Front Panel Connections
for 2098-DSD-005-DN, -005X-DN, -010-DN, -010X-DN, -020-DN, and -020X-DN

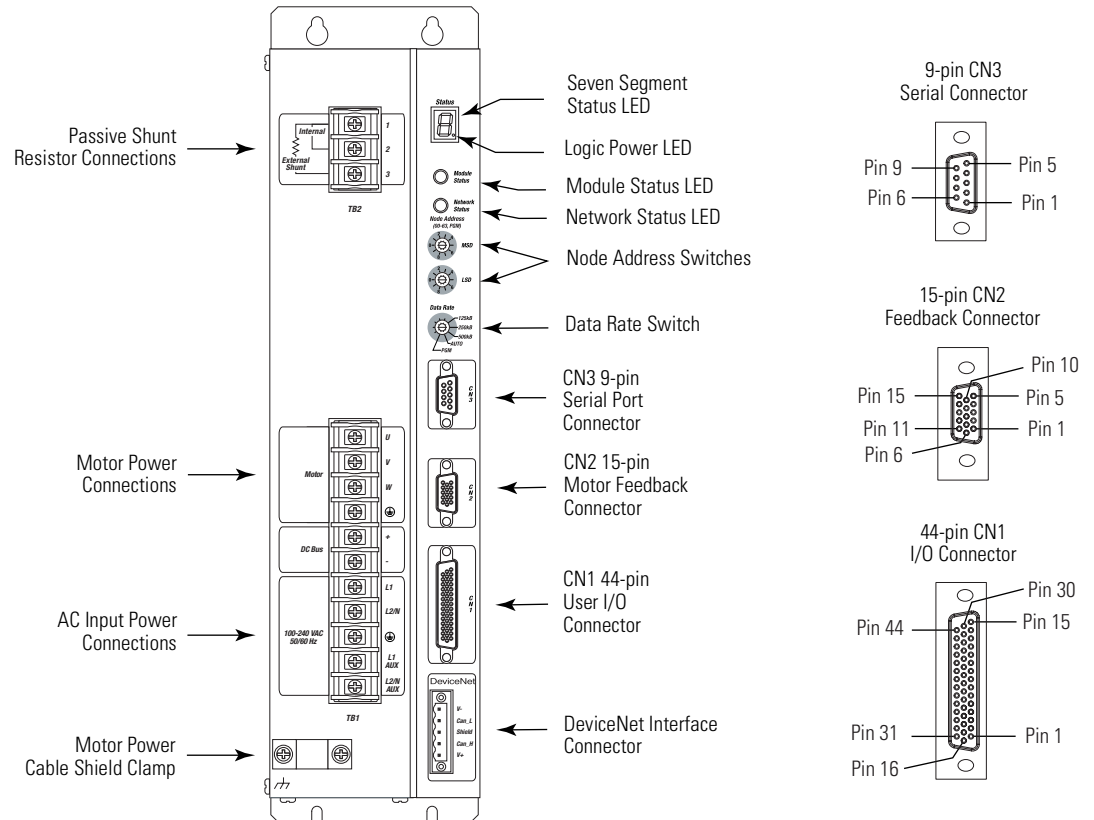


For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the figure below to locate the front panel connections on the Ultra3000-DN 230V drives (3 kW).

Figure 1.16

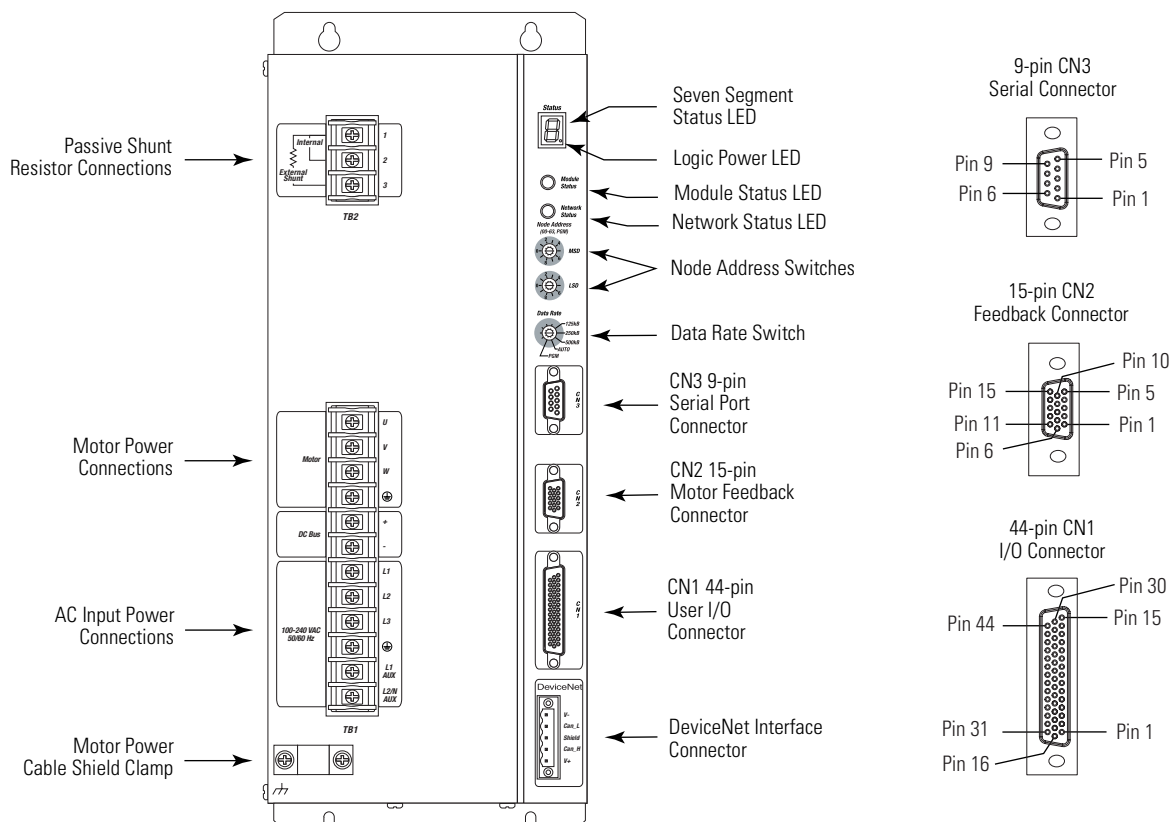
Ultra3000-DN Front Panel Connections for 2098-DSD-030-DN and -030X-DN



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

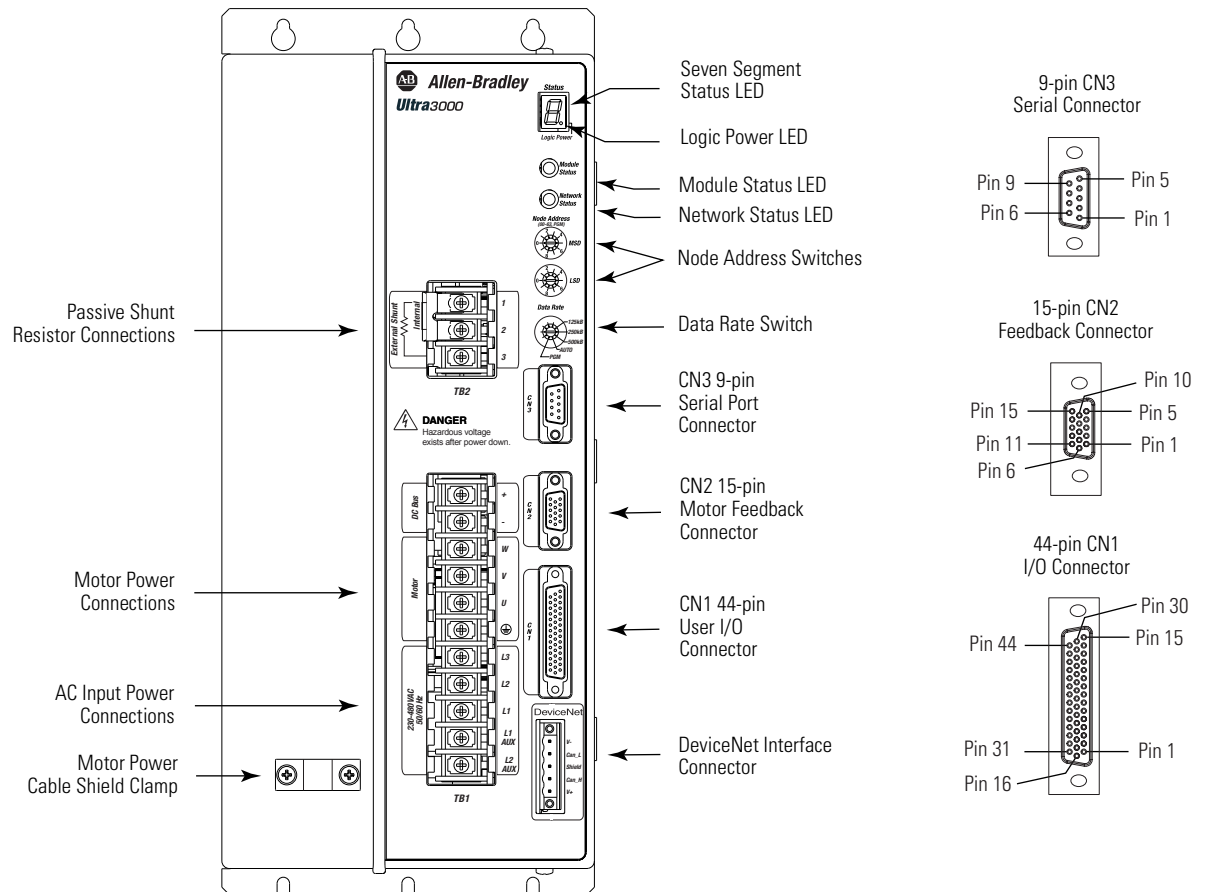
Use the figure below to locate the front panel connections on the Ultra3000-DN 230V drives (7.5 and 15 kW).

Figure 1.17
Ultra3000-DN Front Panel Connections
for 2098-DSD-075-DN, -075X-DN, -150-DN, and -150X-DN



Use the figure below to locate the front panel connections on the Ultra3000-DN 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.18
Ultra3000-DN Front Panel Connections for 2098-DSD-HVxxx-DN and HVxxxX-DN



For CN1, CN2, and CN3 connector pin-out information, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Configuring Your Ultra3000 with DeviceNet

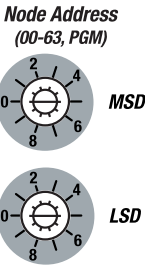
Use the following procedures to configure your Ultra3000-DN drive (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, and -HVxxxX-DN) using Ultraware software and apply power to the drive.

To configure your Ultra3000-DN drive:

1. Verify that there is no power applied to the drive, and the DeviceNet cable is connected (refer to figures 1.15-1.18 for the connector location).
2. Set the node address for each drive in your system. Valid node addresses are 00-63 and PGM. The MSD rotary switch sets the most significant digit and the LSD rotary switch sets the least significant digit. Refer to figures 1.15-1.18 for the switch locations. Refer to the table below for examples.

For this Node Address:	Set the MSD switch to:	Set the LSD switch to:
10	1	0
11	1	1
12	1	2

Use the MSD and LSD rotary switches on the DeviceNet panel of the drive to set node addresses.

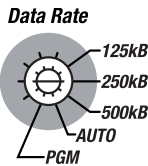


Note: Selecting an invalid node address (> 63) sets the node address according to a non-volatile parameter stored in the drive.

3. Set the data rate. Valid data rates are 125 kps, 250 kps, 500 kps, AUTO, and PGM. Refer to figures 1.15-1.18 for the switch location.

Note: Selecting AUTO automatically matches the device data rate to the rate of the network. Selecting PGM sets the data rate according to a non-volatile parameter stored in the drive.

Use the Data Rate rotary switch on the DeviceNet panel of the drive to set the data rate.



Applying Power To Your Ultra3000 with DeviceNet

This procedure assumes you have wired your Ultra3000-DN system, verified the wiring, and are ready to begin using your Ultraware software.

ATTENTION



High voltage exists in AC line filters. The filter must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels. Failure to observe this precaution could result in personal injury.

To apply power to your Ultra3000-DN drive:

1. Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.

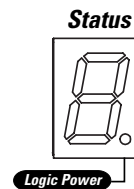
ATTENTION



To avoid damage to the drive due to improper sequencing of input power and the Drive Enable signal, you must assign one of the eight inputs as Drive Enable (Input 1 is the default setting).

2. Apply input power to the Ultra3000-DN and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.19
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	<ol style="list-style-type: none"> 1. Check your input power connections. 2. Repeat main step 2.

3. Observe the front panel seven segment Status LED display as shown in Figure 1.19.

If the Status LED display on your:	Is:	Then:
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or HV-xxxX-DN drive	Actively cycling segments in a full circle	The drive is ready. Go to step 4.
	Flashing an E followed by two numbers	Go to <i>Error Codes</i> on page 2-2.

4. Observe the module status LED.

If the module status LED:	Then:
Is steady green	The drive is ready. Go to step 5.
Is not steady green	Go to <i>SERCOS Module Status LED</i> on page 2-8.

5. Observe the network status LED.

If the network status LED:	Then:
Is off	Establishing communication with network (wait for flashing or steady green).
Is flashing or steady green	Communication is ready. Go to step 6.
Is not flashing or steady green	Go to <i>DeviceNet Network Status LED</i> on page 2-12.

6. For further commissioning procedures, refer to the following sections beginning on page 1-8.

- *Detecting Your Ultra3000 Drive*
- *Understanding the Workspace and Drive Branches*
- *Selecting a Motor*
- *Tuning Your Motor*
- *Testing Your Motor (Non-Indexing Move)*
- *Testing Your Motor (Indexing Move)*
- *Indexing and Non-Indexing Move Examples*

Refer to the *Ultra3000 with DeviceNet Reference Manual* (publication 2098-RM001x-EN-P) for information on communicating to the Ultra3000 using DeviceNet.

Troubleshooting Your Ultra3000

Chapter Objectives

This chapter provides a description of maintenance and troubleshooting activities for the Ultra3000. This chapter includes these sections:

- Safety Precautions
- General Troubleshooting
- Troubleshooting for SERCOS Drives
- Troubleshooting for DeviceNet Drives

Safety Precautions

Observe the following safety precautions when troubleshooting your Ultra3000 drive.

ATTENTION

DC bus capacitors may retain hazardous voltages after input power has been removed. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the drive warning label. Failure to observe this precaution could result in severe bodily injury or loss of life.

Do not attempt to defeat or override the drive fault circuits. You must determine the cause of a fault and correct it before you attempt to operate the system. If you do not correct a drive or system malfunction, it could result in personal injury and/or damage to the equipment as a result of uncontrolled machine system operation.

Test equipment (such as an oscilloscope or chart recorder) must be properly grounded. Failure to include an earth ground connection could result in a potentially fatal voltage on the oscilloscope chassis.

General Troubleshooting

Refer to the *Error Codes* section below to identify problems, potential causes, and appropriate actions to resolve the problems. If problems persist after attempting to troubleshoot the system, please contact your Allen-Bradley representative for further assistance. To determine if your Ultra3000 drive has an error, refer to the table below.

If the Logic Power LED is ON and the Status LED display on your:	Is:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX drive	Actively cycling segments in a full circle	Your Ultra3000 drive is ready.
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, -HVxxxX-DN drive		Your Ultra3000 drive is ready.
2098-DSD-xxx-SE or -HVxxx-SE drive	Displaying a fixed 4	Your Ultra3000 drive is ready.
All drives	Flashing E followed by two numbers	Your Ultra3000 drive has an error. Proceed to the section <i>Error Codes</i> below.
	Flashing L	Your Ultra3000 drive is in an Overtravel condition and motion restrictions are in effect.

Error Codes

The following list of problematic symptoms (no error code shown) and problems with assigned error codes is designed to help you resolve problems.

When a fault is detected, the seven-segment LED will display an E followed by the flashing of the two-digit error code, one digit at a time. This is repeated until the problem is cleared.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
	Power (PWR) indicator not ON	No AC power or auxiliary logic power.	Verify AC power or auxiliary +5V logic power is applied to the Ultra3000.
		Internal power supply malfunction.	Call your Allen-Bradley representative.
	Power (PWR) indicator is ON, but seven segment Status LED display is OFF. Note: This applies to 2098-DSD-005, -010, and -020 Ultra3000 models only.	Externally applied +5V auxiliary power supply voltage is too low.	Verify that the external +5V auxiliary power supply (as measured at the drive terminals) reads between 5.10V and 5.25V.
	Motor jumps when first enabled	Motor wiring error.	Check motor wiring.
		Incorrect motor chosen.	Verify the proper motor is selected.
	Digital I/O not working correctly	I/O power supply disconnected.	Verify connections and I/O power source.
E01	Non-Volatile Memory Endurance Exceeded	Range of motion and number of home position definitions during the product life exceeds the maximum allowed (applies only to systems with absolute feedback).	This is an unrecoverable fault, the drive must be sent back to the factory.
E02	Velocity Exceeds Position Rollover /2	The velocity command or feedback exceeds half the machine cycle length per millisecond (applies only when the machine cycle position rollover is enabled).	Increase machine cycle size or reduce velocity profile. This error only applies to firmware versions prior to 1.10.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
E03	Absolute Feedback Range Exceeded	The motor position exceeds +/- 2047 revolutions from the home position (applies only to systems with absolute feedback).	<ul style="list-style-type: none"> Decrease application range of motion. Upgrade firmware.
E04	Motor Overtemperature	Motor thermostat trips due to: <ul style="list-style-type: none"> High motor ambient temperature and/or Excessive current 	<ul style="list-style-type: none"> Operate within (not above) the continuous torque rating for the ambient temperature (40°C maximum). Lower ambient temperature, increase motor cooling.
		Motor wiring error.	Check motor wiring.
		Incorrect motor selection.	Verify the proper motor has been selected.
E05	IPM Fault	Motor cables shorted.	Verify continuity of motor power cable and connector.
		Motor winding shorted internally.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
		Ultra3000 temperature too high.	<ul style="list-style-type: none"> Check for clogged vents or defective fan. Ensure cooling is not restricted by insufficient space around the unit.
		Operation above continuous power rating.	<ul style="list-style-type: none"> Verify ambient temperature is not too high. Operate within the continuous power rating. Reduce acceleration rates.
		Ultra3000 has a bad IPM output, short circuit, or overcurrent.	Remove all power and motor connections, and perform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
		An attempt was made to enable the drive without waiting at least 1.0 second after applying the main AC power. Note: This applies to 2098-DSD-005, -010, and -020 Ultra3000 models only (when using an external +5V auxiliary power supply).	Wait at least 1.0 second after the main AC is applied before enabling the drive.
E06	Hardware Overtravel (SERCOS only)	Dedicated overtravel input is inactive.	<ul style="list-style-type: none"> Check wiring. Verify motion profile.
E07	RESERVED		Call your local Allen-Bradley representative.
E08	RESERVED		
E09	Bus Undervoltage	Low AC line/AC power input.	<ul style="list-style-type: none"> Verify voltage level of the incoming AC power. Check AC power source for glitches or line drop. Install an uninterruptible power supply (UPS) on your AC input.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
E10	Bus Overvoltage	Excessive regeneration of power. When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the Ultra3000's power supply. The system faults to save itself from an overload.	<ul style="list-style-type: none"> Change the deceleration or motion profile. Use a larger system (motor and Ultra3000). Use a resistive shunt. If a shunt is connected, verify the wiring is correct and shunt fuse is not blown.
		Excessive AC input voltage.	Verify input is within specifications.
E11	Illegal Hall State	Incorrect phasing.	Check the Hall phasing.
		Bad connections.	<ul style="list-style-type: none"> Verify the Hall wiring. Verify 5V power supply to the encoder.
E12	Home Search Failed	Home sensor and/or marker is outside the overtravel limits.	<ul style="list-style-type: none"> Check wiring. Reposition the overtravel limits or sensor.
E13	Home Position In Limit	Home sensor, marker, or final home position exceeds a hardware overtravel limit.	<ul style="list-style-type: none"> Reposition the overtravel limits or home sensor. Adjust the final home position.
E14	SERCOS Hardware Fault (SERCOS drives only)	A fault was detected with the operation of the drive's internal SERCOS hardware.	Contact your local Allen-Bradley representative.
	DeviceNet Communications Network problem (DeviceNet drives only)	DeviceNet communications network is broken	Troubleshoot DeviceNet communications.
E15	Excessive Electrical Cycle Length	Electrical cycle length exceeds maximum lines per electrical cycle	Replace the linear motor/encoder.
E16	Software Overtravel (SERCOS only)	Programmed overtravel limit has been exceeded.	<ul style="list-style-type: none"> Verify motion profile. Verify overtravel settings are appropriate.
E17	User-Specified Current Fault	User-Specified average current level has been exceeded.	Increase to a less restrictive setting.
E18	Overspeed Fault	Motor speed has exceeded 125% of maximum rated speed.	<ul style="list-style-type: none"> Check cables for noise. Check tuning.
E19	Excess Position Error	Position error limit was exceeded.	<ul style="list-style-type: none"> Increase the feedforward gain. Increase following error limit or time. Check position loop tuning.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
E20	Motor Encoder State Error	The motor encoder encountered an illegal transition.	<ul style="list-style-type: none"> • Replace the motor/encoder. • Use shielded cables with twisted pair wires. • Route the feedback away from potential noise sources. • Check the system grounds. • Verify that the unbuffered encoder signals are not subjected to EMI in the CN1 cable. Remove these signals from the CN1 cable if they are not being used. • Verify that the motor has a high-frequency bond to the drive's enclosure panel. • Verify that any stage connected to the motor shaft (for example using a ball screw) has a high-frequency bond to the machine frame and the drive's enclosure panel.
		Bad encoder.	Replace motor/encoder.
E21	Auxiliary Encoder state error	The auxiliary encoder encountered an illegal transition.	<ul style="list-style-type: none"> • Use shielded cables with twisted pair wires. • Route the encoder cable away from potential noise sources. • Bad encoder - replace encoder. • Check the ground connections.
		Setup time violation for Step/Direction or CW/CCW input.	Check timing of Step/Direction or CW/CCW inputs to determine if setup time requirements are being met.
E22	Motor Thermal Protection Fault	The internal filter protecting the motor from overheating has tripped.	<ul style="list-style-type: none"> • Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Ultra3000 and motor. • Check tuning.
E23	IPM Thermal Protection Fault	The internal filter protecting the drive from over heating has tripped.	<ul style="list-style-type: none"> • Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Ultra3000 and motor. • Check tuning.
E24	Excess Velocity Error	Velocity error limit was exceeded.	<ul style="list-style-type: none"> • Increase time or size of allowable error. • Reduce acceleration. • Check tuning.
E25	Sensor Not Assigned	Homing or registration motion was attempted without a sensor assigned.	Assign a sensor to a digital input.
E26	User-Specified Velocity Fault	User specified velocity level was exceeded.	Increase to a less restrictive setting.
E27	Axis Not Homed	Absolute positioning was attempted without homing.	Verify homing sequence.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
E28	Motor Parameter Error	Parameter loaded from smart encoder or received from SERCOS controller is incompatible with the drive.	<ul style="list-style-type: none"> Select a different motor through the SERCOS controller. Select a different motor.
E29	Encoder Output Frequency Exceeded	Encoder output frequency exceeds the maximum user specified value. This only applies when the encoder output is synthesized by the drive.	<ul style="list-style-type: none"> Increase the encoder output maximum frequency parameter. Decrease the encoder interpolation parameter. Increase the encoder output divider parameter.
E30	Encoder Communication Fault	Communication was not established with an intelligent encoder.	<ul style="list-style-type: none"> Verify motor selection. Verify the motor supports automatic identification. Verify motor encoder wiring.
E31	Encoder Data	Encoder data is corrupted.	Replace the motor/encoder.
E32	Sine/Cosine Encoder Frequency Limit Exceeded	Maximum frequency of the sine/cosine circuitry has been exceeded.	<ul style="list-style-type: none"> Decrease velocity. Use encoder with lower resolution (before interpolation).
E33	Absolute Position Exceeds Position Rollover	<p>Motion is commanded to a position outside the position rollover range.</p> <ul style="list-style-type: none"> An absolute index is initiated that specifies a position outside the position rollover range. A homing cycle is initiated with the home position outside the position rollover range. A define home is initiated with the home position outside the position rollover range. A preset position is initiated that specifies a position outside the position rollover range. 	Set motion command to a position within the position rollover range.
E34	Ground Fault	Wiring error.	Check motor power wiring.
		Motor internal ground short.	Replace motor.
		Internal malfunction.	Disconnect motor power cable from drive and enable drive with current limit set to 0. If fault remains, call your Allen-Bradley representative. If fault clears, then a wiring error or motor internal problem exists.
E35	Precharge Fault	Low AC input voltage.	Check input AC voltage on all phases.
		Internal malfunction.	Call your Allen-Bradley representative.
E36	Power Circuitry Overtemperature	Excessive heat exists in the power circuitry.	<ul style="list-style-type: none"> Reduce acceleration rates. Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. Use larger Ultra3000 and motor. Check tuning.
E37	AC Line Loss	One or more phases of the input AC power is missing.	Check input AC voltage on all phases.
E38	RESERVED		Call your local Allen-Bradley representative.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
E39	Self-sensing Commutation Startup Error	Motion required for self-sensing startup commutation was obstructed.	<ul style="list-style-type: none"> Verify that there are no impediments to motion at startup, such as hard limits. Increase self-sensing current if high friction or load conditions exist. Check motor or encoder wiring using wiring diagnostics.
E40	230V Shunt Protection Fault	Ineffective shunt resistor	<ul style="list-style-type: none"> Verify that the shunt resistor (internal or external) is connected. If an external shunt resistor is connected, verify that the shunt fuse is not blown. If a non Allen-Bradley external shunt resistor is used, verify that the resistance value is within specifications. Verify that the motor is not being driven mechanically, causing the motor to behave as a generator.
		Excessive regeneration	
E41	460V Shunt Protection Fault	Ineffective shunt resistor	
		Excessive regeneration	
E42	Motor Keying Error (SERCOS drives only)	The motor physically connected to the drive differs from the motor specified in the user program.	Select the correct motor in the user program.
E43	Drive Enable Input (SERCOS drives only)	<ul style="list-style-type: none"> An attempt was made to enable the axis through software while the Drive Enable hardware input was inactive. The Drive Enable input transitioned from active to inactive while the axis was enabled. 	<ul style="list-style-type: none"> Disable the Drive Enable Input fault. Verify that Drive Enable hardware input is active whenever the drive is enabled through software.
E50	Duplicate Node Fault (SERCOS drives only)	Duplicate node address detected on SERCOS ring.	Verify that each SERCOS drive is assigned a unique node address.
All others	RESERVED		Call your local Allen-Bradley representative.

Troubleshooting for SERCOS Drives

SERCOS Module Status LED

Use the table below for troubleshooting the SERCOS Module Status LED on your Ultra3000 (2098-DSD-xxx-SE or -HVxxx-SE).

If the SERCOS Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Normal	Drive is enabled.	Normal operation when drive is enabled.
Flashing Green	Standby	Drive is not enabled.	Normal operation when drive is disabled.
Flashing Red-Green	DC Bus Undervoltage	The DC bus voltage is low.	<ul style="list-style-type: none"> Normal operation when using auxiliary power (main AC power is not applied). When using main AC power, refer to the section <i>Error Codes</i> to continue troubleshooting.
Flashing Red	Minor fault	Drive is faulted, but the fault can be cleared.	Refer to the section <i>Error Codes</i> to continue troubleshooting.
Steady Red	Unrecoverable fault	Drive is faulted, and the fault cannot be cleared.	Contact your local Allen-Bradley representative.

SERCOS Network Status LED

Use the table below for troubleshooting the SERCOS Network Status LED on your Ultra3000 (2098-DSD-xxx-SE or -HVxxx-SE).

If the SERCOS Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Communication ready	No faults or failures.	N/A
Flashing Green	Establishing communication	System is still in the process of establishing SERCOS communication.	Wait for steady green LED status.
		Node address setting on the drive module does not match SERCOS controller configuration.	Verify proper node switch setting.
Flashing Red	No communication ¹	Loose fiber optic connection.	Verify proper fiber optic cable connections.
		Broken fiber optic cable.	Replace fiber optic cable.
		Receive fiber optic cable connected to SERCOS transmit connector and vice versa.	Check proper SERCOS fiber optic cable connections.

¹ Refer to *Fiber Optic Cable Installation and Handling Instructions* (publication 2090-IN010x-EN-P) for more information.

Understanding Logix/Drive Fault Behavior

This section provides the Ultra3000-SE drive fault actions and indicates whether the fault action is programmable.

The following drive fault action definitions apply:

Drive Fault Action	Definition
Disable Drive	The drive is disabled. Uncontrolled Stop, motor coasts to a stop.

When a fault is detected, the seven-segment LED will display an E followed by the flashing of the two-digit error code, one digit at a time. This is repeated until the problem is cleared.

Fault Message RSLogix (Ultraware)	Error Code	Description	Drive Fault Action	RSLogix Programmable Fault Action?
DriveHardFault (Non-Volatile Memory Endurance Exceeded)	E01	Range of motion and number of home position definitions during the product life exceeds the maximum allowed (applies only to systems with absolute feedback).	DISABLE	NO
DriveHardFault (Velocity Exceeds Position Rollover /2)	E02	The velocity command or feedback exceeds half the machine cycle length per millisecond (applies only when the machine cycle position rollover is enabled).	DISABLE	NO
DriveHardFault (Absolute Feedback Range Exceeded)	E03	The motor position exceeds +/- 2047 revolutions from the home position (applies only to systems with absolute feedback).	DISABLE	NO
MotorOvertempFault (Motor Overtemperature)	E04	The motor thermal switch was tripped.	DISABLE	YES
DriveHardFault (IPM Fault)	E05	A problem in the drive power structure was detected. Motor cables shorted, motor winding shorted internally, temperature too high, operation above continuous power rating, or has a bad IPM output, short circuit, or overcurrent.	DISABLE	NO
HardOvertravelFault (+/- Hard Overtravel)	E06	Axis moved beyond the physical travel limits in the positive/negative direction. This fault can be configured for status only.	DISABLE	YES
MotFeedbackFault (Channel BM Line Loss)	E07	The feedback wiring is open, shorted or missing.	DISABLE	NO
MotFeedbackFault (Channel AM Line Loss)	E08	The feedback wiring is open, shorted or missing.	DISABLE	NO
DriveUndervoltageFault (Bus Undervoltage)	E09	With 3 phase present, the DC bus voltage is below limits. The trip point is 275V and 137V DC for 460V/230V drives respectively.	DISABLE	NO
DriveOvervoltageFault (Bus Overvoltage)	E10	The DC bus voltage is above limits. The trip point is 820V and 410V dc for 460V/230V drives respectively.	DISABLE	NO
CommutationFault (Illegal Hall State)	E11	State of Hall inputs is incorrect.	DISABLE	NO
DriveHardFault (Home Search Failed)	E12	Home sensor and/or marker is outside the overtravel limits.	DISABLE	NO
DriveHardFault (Home Position In Limit)	E13	Home sensor, marker, or final home position exceeds a hardware overtravel limit.	DISABLE	NO

Fault Message RSLogix (Ultraware)	Error Code	Description	Drive Fault Action	RSLogix Programmable Fault Action?
SERCOSFault (SERCOS or DeviceNet Communications Network problem)	E14	SERCOS or DeviceNet communications network is broken	DISABLE	NO
DriveHardFault (Excessive Electrical Cycle Length)	E15	Configuration information is not valid.	N/A	NO
SoftOvertravelFault (+/- Software Overtravel)	E16	Programmed positive/negative overtravel limit has been exceeded.	DISABLE	YES
DriveHardFault (User-Specified Current Fault)	E17	User-Specified average current level has been exceeded.	DISABLE	NO
OverspeedFault (Overspeed Fault)	E18	Motor speed has exceeded 125% of maximum rated speed.	DISABLE	NO
PositionErrorFault (Excess Position Error)	E19	Axis position error limit has been exceeded. This fault can be configured for status only.	DISABLE	YES
MotFeedbackFault (Motor Encoder State Error)	E20	The motor encoder encountered an illegal transition.	DISABLE	NO
AuxFeedbackNoiseFault (Auxiliary Encoder State Error)	E21	The auxiliary encoder encountered an illegal transition.	DISABLE	NO
OverloadFault (Motor Thermal Protection Fault)	E22	The internal filter protecting the motor from overheating has tripped.	DISABLE	YES
DriveOvertempFault (IPM Thermal Protection Fault)	E23	The internal filter protecting the drive from over heating has tripped.	DISABLE	YES
DriveHardFault (Excess Velocity Error)	E24	Velocity error limit was exceeded.	DISABLE	NO
DriveHardFault (Sensor Not Assigned)	E25	Homing or registration motion was attempted without a sensor assigned.	DISABLE	NO
DriveHardFault (User-Specified Velocity Fault)	E26	User specified velocity level was exceeded.	DISABLE	NO
DriveHardFault (Axis Not Homed)	E27	Absolute positioning was attempted without homing.	DISABLE	NO
DriveHardFault (Motor Parameter Error)	E28	Parameter loaded from smart encoder or received from SERCOS controller is incompatible with the drive.	DISABLE	NO
DriveHardFault (Encoder Output Frequency Exceeded)	E29	Encoder output frequency exceeds the maximum user specified value. This only applies when the encoder output is synthesized by the drive.	DISABLE	NO
DriveHardFault (Encoder Communication Fault)	E30	Communication was not established with an intelligent (i.e. Stegmann) encoder on the motor feedback port.	DISABLE	NO
DriveHardFault (Encoder Data)	E31	Encoder data is corrupted.	DISABLE	NO

Fault Message RSLogix (Ultraware)	Error Code	Description	Drive Fault Action	RSLogix Programmable Fault Action?
DriveHardFault (Sine/Cosine Encoder Frequency Limit Exceeded)	E32	Maximum frequency of the sine/cosine circuitry has been exceeded.	DISABLE	NO
DriveHardFault (Absolute Position Exceeds Position Rollover)	E33	Absolute position exceeds position rollover.	DISABLE	NO
DriveHardFault (Ground Fault)	E34	Excessive ground current in the converter was detected.	DISABLE	NO
DriveHardFault (Precharge Fault)	E35	The converter pre-charge cycle has failed.	DISABLE	NO
DriveHardFault (Power Circuitry Overtemperature)	E36	Excessive heat exists in the power circuitry.	DISABLE	NO
DriveHardFault (AC Line Loss)	E37	One or more phases of the input AC power is missing.	DISABLE	NO
SERCOSFault (SERCOS Ring Fault)	E38	The SERCOS ring is not active after being active and operational.	DISABLE	NO
DriveHardFault (Self-sensing Commutation Startup Error)	E39	Self-sense commutation fault detected	DISABLE	NO
DriveHardFault (230V Shunt Protection Fault)	E40	Ineffective shunt resistor	DISABLE	NO
DriveHardFault (460V Shunt Protection Fault)	E41	Ineffective shunt resistor	DISABLE	NO
ConfigFault (Motor Keying Error)	E42	The motor physically connected to the drive differs from the motor specified in the user program.	N/A	NO
DriveEnableInputFault (Drive Enable Input)	E43	Generated when Enable input switches off when drive is enabled.	DISABLE	YES
SERCOSFault (Duplicate Node Fault)	E50	Duplicate node address detected on SERCOS ring.	DISABLE	NO
RESERVED	All Others			

Troubleshooting for DeviceNet Drives

DeviceNet Module Status LED

Use the table below for troubleshooting the DeviceNet Module Status LED on your Ultra3000 (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or -HVxxxX-DN).

If the Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	Not powered	No power	There is no power going to the device.
Steady-Green	Operational	Normal operation	Normal operation - no action needed.
Flashing-Green	Device is in stand-by	Processing or waiting for input	Normal operation - no action needed.
Flashing-Red	Recoverable fault	Not operational	Power cycle or reset the drive.
Steady-Red	Unrecoverable fault	Drive problem	1. Check drive for power-up error. 2. Replace drive.
Flashing-Red/Green	Self testing	Self-test in progress	The device is in self test, wait.

DeviceNet Network Status LED

Use the table below for troubleshooting the DeviceNet Network Status LED on your Ultra3000 (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or -HVxxxX-DN).

If the Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	<ul style="list-style-type: none"> Not powered Not on-line 	<ul style="list-style-type: none"> No power going to the device Failed Duplicate MAC ID check 	<ol style="list-style-type: none"> Check the Module Status LED to verify that the drive is powered. Check that one or more nodes are communicating on the network. Check that at least one other node on the network is operational and the data rate is the same as the drive.
Flashing-green	<ul style="list-style-type: none"> On-line Not connected 	<ul style="list-style-type: none"> Passed Duplicate MAC ID check No connection established 	No action is needed. The LED is flashing to signify that there are no open communication connections between the drive and any other device. Any connection (I/O or explicit message) made to the drive over DeviceNet will cause the LED to stop flashing and remain Steady-ON for the duration of any open connection.
Steady-green	<ul style="list-style-type: none"> On-line Connected 	One or more connections established	No action needed. This condition is normal.
Flashing-red	<ul style="list-style-type: none"> On-line Time-out 	I/O connection timed out	<ol style="list-style-type: none"> Re-initiate I/O messaging by the master controller. Reduce traffic or errors on the network so that messages can get through within the necessary time frame.
Steady-red	Network Failure	<ul style="list-style-type: none"> Failed Duplicate MAC ID check Bus-off 	<ol style="list-style-type: none"> Ensure that all nodes have unique addresses. If all node addresses are unique, examine network for correct media installation. Ensure that all nodes have the same Data Rate.

Node Problems

Give particular attention to the task of setting initial addresses and data rates. Survey the network to ensure all assignments are known. Some nodes can be logically assigned to a group of devices, but physically located away from those devices. One incorrect node can cause other nodes to appear to be Bus-off (Steady-Red LED). If a node goes Bus-off and the device is reset only to go Bus-off again, the problem is likely not with the device, but rather the setting of the address, data rate, or a network-wide problem related to topology, grounding, intermittent power/data connections, or electrical noise. If a scanner goes Bus-off, nodes will not reallocate (Flashing-green or red) even if they are functioning correctly.

Device Failure - LED Status Check

A Steady-Red Module Status LED can mean an error. If the Network Status LED goes Steady-Red at power-up, it could mean there is a Duplicate MAC ID. The user response is to test all devices for unique addresses. If a Steady-Red LED remains on after the Duplicate MAC ID test shows all devices to have a unique node address, it means a Bus-off error. Do the following:

1. Check data rate settings.
2. If symptom persists, replace node address (with another address and correct data rate).
3. If symptom persists, replace tee tap.
4. If symptom persists, check topology.
5. If symptom persists, check power for noise with oscilloscope or power disturbance analyzer.

Scanner Problems

If using a scanner, check the scan list, data rate, and addresses of devices. Verify series and revision of the scanner is the latest. If the scanner is Bus-off, recycle the 24V supply and then reset the scanner. If the scanner goes Bus-off again, the problem is some combination of:

- Defective node device
- Incorrect node data rate
- Bad network topology
- Faulty wiring
- Faulty scanner
- Faulty power supply
- Bad grounding
- Electrical noise

Power Supply Problems

If a single power supply is used, add up the current requirements of all devices drawing power from the network. This total should be considered the minimum current rating in selecting the power supply used. In addition check the:

- Length and current level in trunk and drop cables
- Size and length of the cable supplying power to the trunk
- Voltage measured at the middle and ends of the network
- Noise in network power measured with an oscilloscope

Cable Installation and Design Problems

Cable installation and design refers to the physical layout and connections on the network. Walk the network if possible to determine the actual layout and connections. Network management software displays only a logical record of the network. Ensure that you have a diagram of the physical layout and a record of the information from the tables below.

Cable Checks	Power Checks
Number of nodes.	Break the earth ground of the V- and Shield and verify >1.0 Mohm to frame ground with power supply off.
Individual drop lengths.	Use a multi-meter to check for short circuit between CAN_H and CAN_L, or CAN (H or L) to Shield, V- or V+.
Branched drop length.	Total power load and at its distribution points.
Cumulative drop length.	Spot check power for noise.
Total trunk length.	
Power supply cable length and gauge.	
Terminator locations and size.	

Adjusting the Physical Network Configuration

Ways to improve the efficiency of your physical network configuration include:

- Shortening the overall length of the cable system
- Moving the power supply in the direction of an overloaded cable section
- Moving devices from an overloaded cable section to a less loaded section
- Moving higher current loads closer to the power supply
- Adding another power supply to an overloaded network

Moving the power supply from the end to the middle of the network

Interconnect Diagrams

Chapter Objectives

This appendix contains the following interconnect diagrams:

- Power Interconnect Diagrams
- Shunt Module Interconnect Diagrams
- Ultra3000/Motor Interconnect Diagrams
- Control String Examples (120V ac)
- Controlling a Brake Example
- Ultra3000 to Logix Cable and Interconnect Diagrams
- Ultra3000 to IMC-S Compact Cable and Interconnect Diagram

Ultra3000 Interconnect Diagram Notes

The notes in the table below apply to the power, drive/motor, shunt, and 120V ac control string interconnect diagrams.

ATTENTION



The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes are the responsibility of the machine builder.

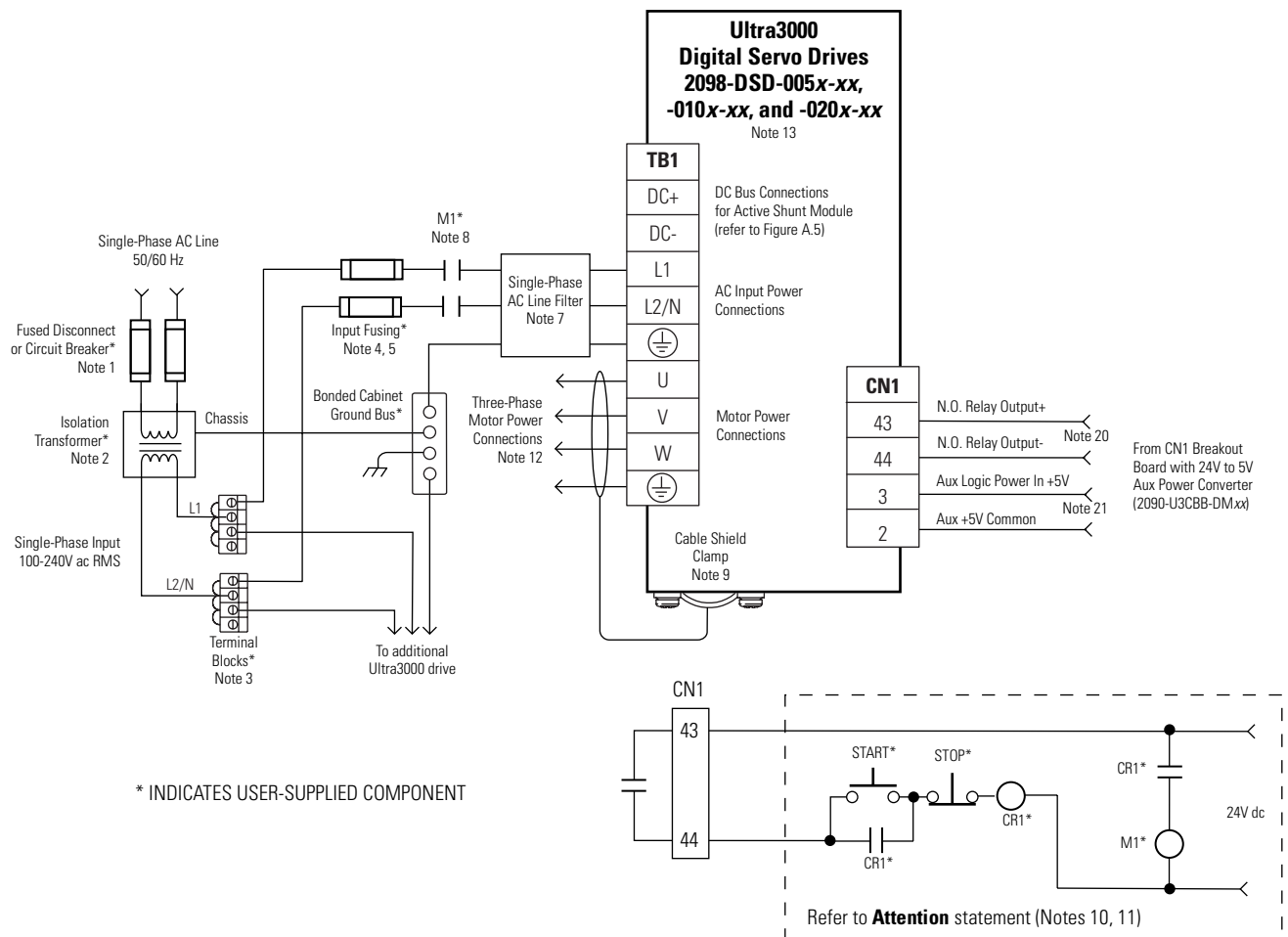
Note:	Information:	
1	A disconnecting device is required for maintenance and safety. If a grounded neutral is used instead of L2, only L1 may be switched or fused.	
2	An isolation transformer is optional. If the transformer secondary has a neutral connection, neutral must be bonded to ground. Multiple drive modules may be powered from one transformer or other AC supply source.	
3	Do not daisy chain drive module power connections. Make separate connections directly to the AC supply.	
4	For power wiring specifications, refer to the <i>Ultra3000 Installation Manual</i> (publication 2098-IN003x-EN-P).	
5	For input fuse sizes, refer to the <i>Ultra3000 Installation Manual</i> (publication 2098-IN003x-EN-P).	
6	May be used to maintain power to logic section of drive and status LEDs when main AC input power is removed. A separate AC line source may be used if voltage is between 88-265V ac _{RMS} on 2098-DSD-xxx (230V drives) or 207-528V ac _{RMS} on 2098-DSD-HVxxx (460V drives).	
7	For AC line filter specifications, refer to the <i>Ultra3000 Installation Manual</i> (publication 2098-IN003x-EN-P).	
8	Drive Enable input must be opened when main power is removed and auxiliary power is present, or a drive fault will occur. A delay of at least 1.0 second must be observed before attempting to enable the drive after main power is restored.	
9	Cable shield clamp must be used in order to meet CE requirements. No external connection to chassis ground required.	
10		Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories. For more information refer to <i>Understanding the Machinery Directive</i> (publication SHB-900).
11	The recommended minimum wire size for wiring the safety circuit to the contactor enable connector is 1.5 mm ² (16 AWG).	
12	For motor cable specifications and drive/motor cable combinations, refer to the <i>Motion Control Selection Guide</i> (publication GMC-SG001x-EN-P).	
13	The Ultra3000 referenced is either a 2098-DSD-xxx or -xxxX (Ultra3000 with indexing), -xxx-SE (SERCOS interface), -xxx-DN (DeviceNet interface), -xxxX-DN (DeviceNet with indexing) 230V drive.	
14	The Ultra3000 referenced is either a 2098-DSD-HVxxx or -HVxxxX (Ultra3000 with indexing), -HVxxx-SE (SERCOS interface), -HVxxx-DN (DeviceNet interface), -HVxxxX-DN (DeviceNet with indexing) 460V drive.	
15	Wire colors are for flying lead cable (2090-XXNFxx-Sxx) and may vary from the premolded connector cable (2090-UXNFBxx-Sxx). Wires without terminations at the drive are not shown for clarity.	
16	If flying lead feedback cable has a drain wire, it must be folded back and clamped with the cable shield (CN2 breakout board 2090-UXBB-DM15).	
17	Only the MPG-Bxxx encoder uses the +5V dc supply. MPL-Bxxx and 1326AB (M2L/S2L) encoders use the +9V dc supply.	
18	Only the MPL-A5xx and MPF-A5xx encoders use the +9V dc supply. MPG-Axxx encoders use the +5V dc supply.	
19	Use a flyback diode for noise suppression of the motor brake coil. For more information, refer to <i>System Design for Control of Electrical Noise Reference Manual</i> (publication GMC-RM001x-EN-P).	
20	Relay Output (CN1, pins 43 and 44) must be configured as Ready in Ultraware software.	
21	The preferred method for supplying the auxiliary power is by using the 12- or 44-pin drive-mounted breakout board with 24V to 5V auxiliary power converter (catalog number 2090-U3CBB-DM12 or -DM44). Auxiliary +5V power is required to maintain encoder position when the main AC power is disconnected.	

Power Interconnect Diagrams

The Ultra3000 (2098-DSD-005x-xx, -010x-xx, and -020x-xx) power wiring with 24V dc control string (non-SERCOS drives only) is shown in the figure below. To avoid a separate 5V dc auxiliary logic power supply, the 24V to 5V converter breakout board (2090-U3CBB-DMxx) is used to wire the control interface (CN1) connector. For the control string diagram with 120V ac input refer to Figure A.16.

For SERCOS drives, input line contactor is part of the PLC program and output control.

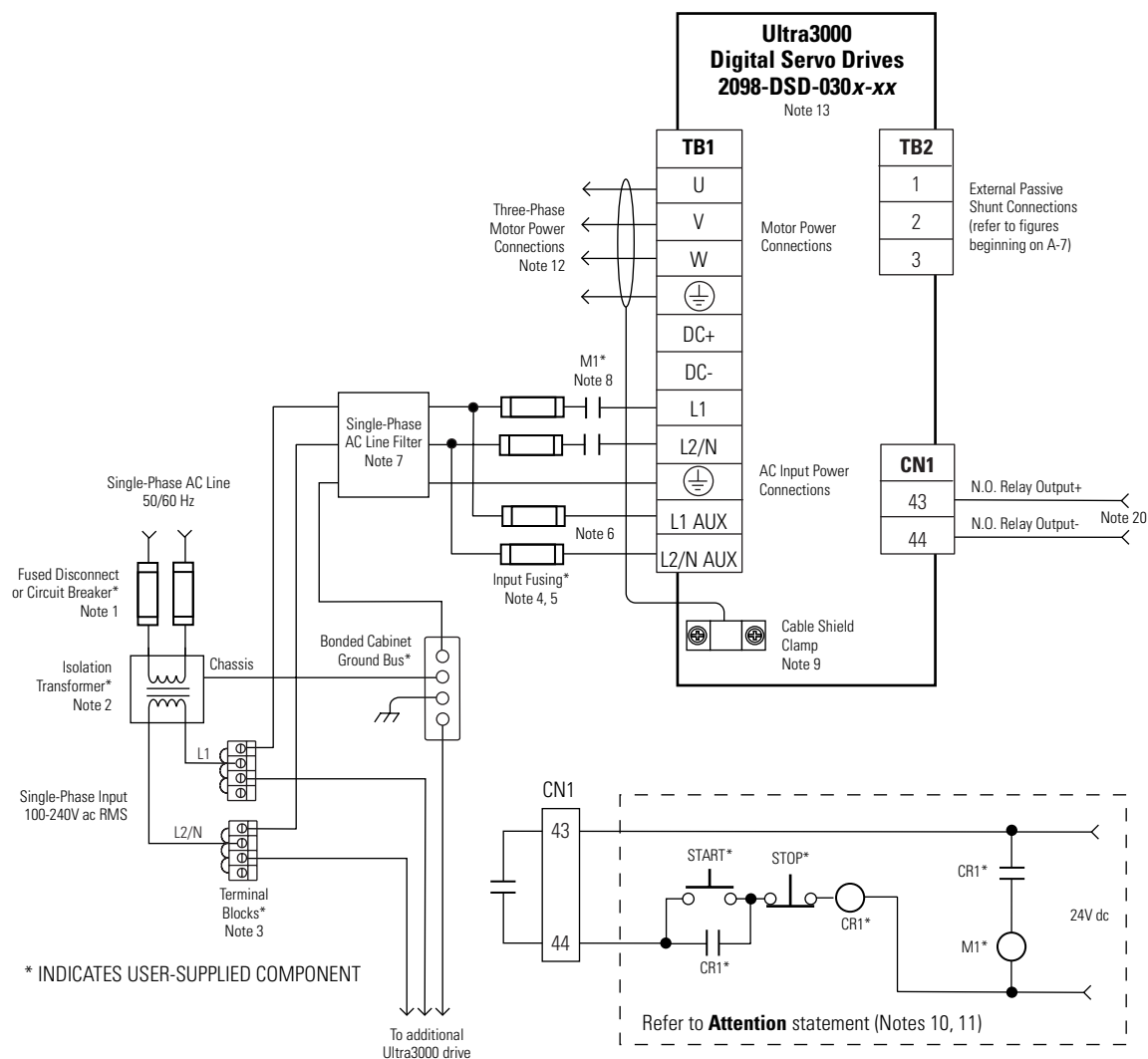
Figure A.1
Typical Power Wiring of Ultra3000 System
(2098-DSD-005x-xx, -010x-xx, and -020x-xx)



The Ultra3000 (2098-DSD-030x-xx) power wiring with 24V dc control string (non-SERCOS drives only) is shown in the figure below. For the control string diagram with 120V ac input refer to Figure A.17.

For SERCOS drives, input line contactor is part of the PLC program and output control.

Figure A.2
Typical Power Wiring of Ultra3000 System
(2098-DSD-030x-xx)



For SERCOS drives, input line contactor is part of the PLC program and output control.

Ultra3000 Digital Servo Drives
2098-DSD-075x-xx and -150x-xx
 Note 13

TB1

U
V
W
⏏
DC+
DC-
L1
L2
L3
⏏
L1 AUX
L2/N AUX

Motor Power Connections

AC Input Power Connections

Cable Shield Clamp Note 9

TB2

1
2
3

External Passive Shunt Connections (refer to figures beginning on A-7)

CN1

43 N.O. Relay Output+
44 N.O. Relay Output- Note 20

Three-Phase AC Line 50/60 Hz

Fused Disconnect or Circuit Breaker* Note 1

Isolation Transformer* Note 2

Neutral

Chassis

Three-Phase Input 100-240V ac RMS

Terminal Blocks* Note 3

Three-Phase AC Line Filter Note 7

Input Fusing* Note 4, 5

Bonded Cabinet Ground Bus*

M1* Note 8

Note 6

To additional Ultra3000 drive

CN1

43
44

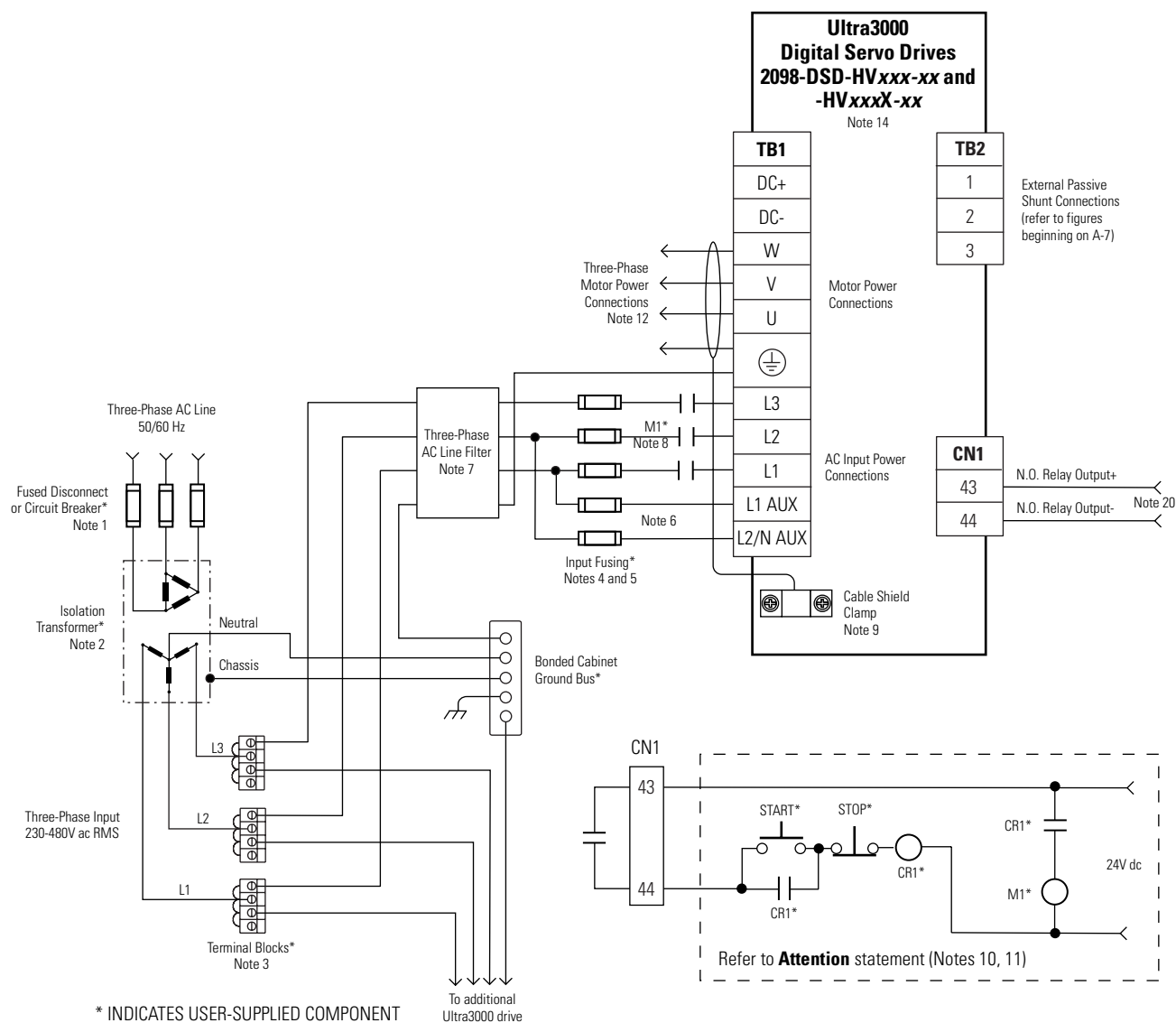
START* STOP* CR1* M1* 24V dc

Refer to **Attention** statement (Notes 10, 11)

* INDICATES USER-SUPPLIED COMPONENT

The Ultra3000 (2098-DSD-HVxxx-xx and -HVxxxX-xx) power wiring with 24V dc control string is shown in the figure below. For the control string diagram with 120V ac input refer to Figure A.18.

Figure A.4
Typical Power Wiring of Ultra3000 System
(2098-DSD-HVxxx-xx and -HVxxxX-xx)



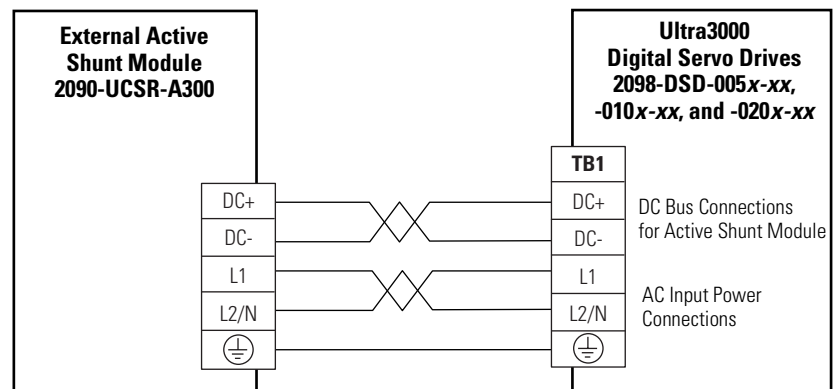
Shunt Module Interconnect Diagrams

This section contains the interconnect diagrams connecting the Ultra3000 drives with active and passive shunt modules.

Active Shunt Module Diagrams

In the figure below, the Ultra3000 (2098-DSD-005x-xx, -010x-xx, or -020x-xx) is shown wired with the 2090-UCSR-A300 active shunt module.

Figure A.5
External Active Shunt Module Interconnect Diagram



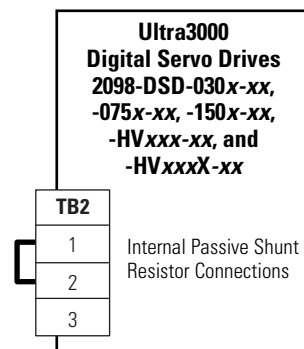
Passive Shunt Module Diagrams

In the Figure A.6, the Ultra3000 is shown wired for internal shunt operation. This is the factory default jumper setting.

IMPORTANT

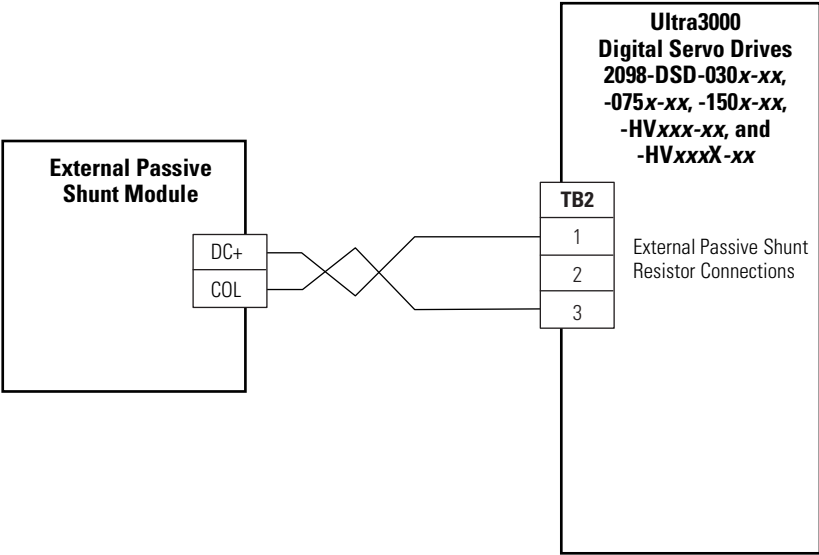
Internal shunt operation is only present on the drives listed in the figure below.

Figure A.6
Internal Shunt Interconnect Diagram



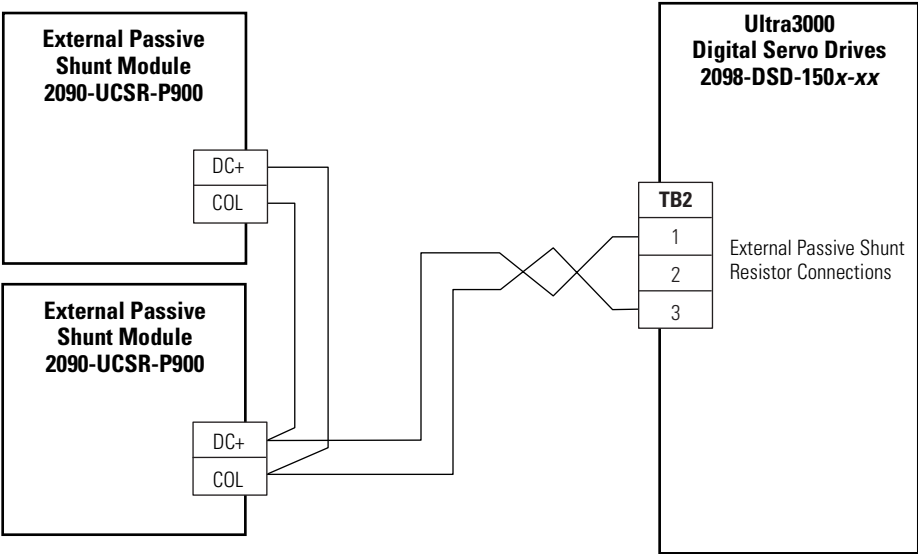
In the figure below, the Ultra3000 is shown wired with an external passive shunt resistor.

Figure A.7
External Passive Shunt Module Interconnect Diagram



In the figure below, the Ultra3000 (2098-DSD-150x-xx) is shown wired with two external passive shunt resistors. When two 900W shunt modules are connected in parallel, the shunt capacity is doubled for a total of 1800W of continuous power dissipation.

Figure A.8
External Passive Shunt Module Interconnect Diagram



In the figure below, the Ultra3000 (2098-DSD-HV150x-xx or -HV220x-xx) is shown wired to a Bonitron shunt module.

Figure A.9
External Passive Shunt Module Interconnect Diagram

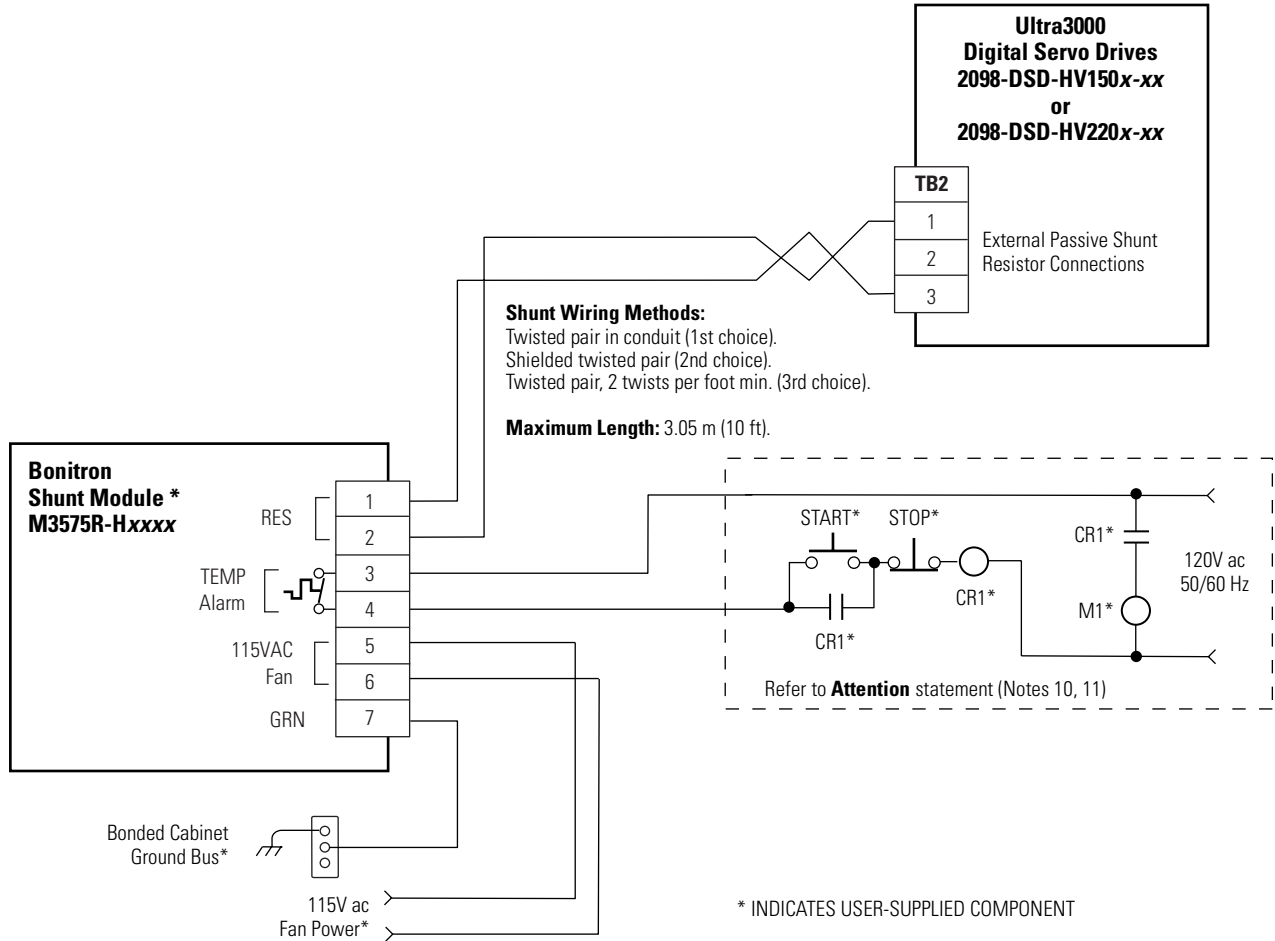


Figure A.11
Ultra3000 to MP-Series (230V) Motor Configuration



Publication 2098-IN005B-EN-P — August 2004

Figure A.12
Ultra3000 to MP-Series Food Grade Motor Configuration

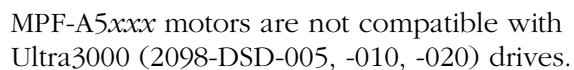
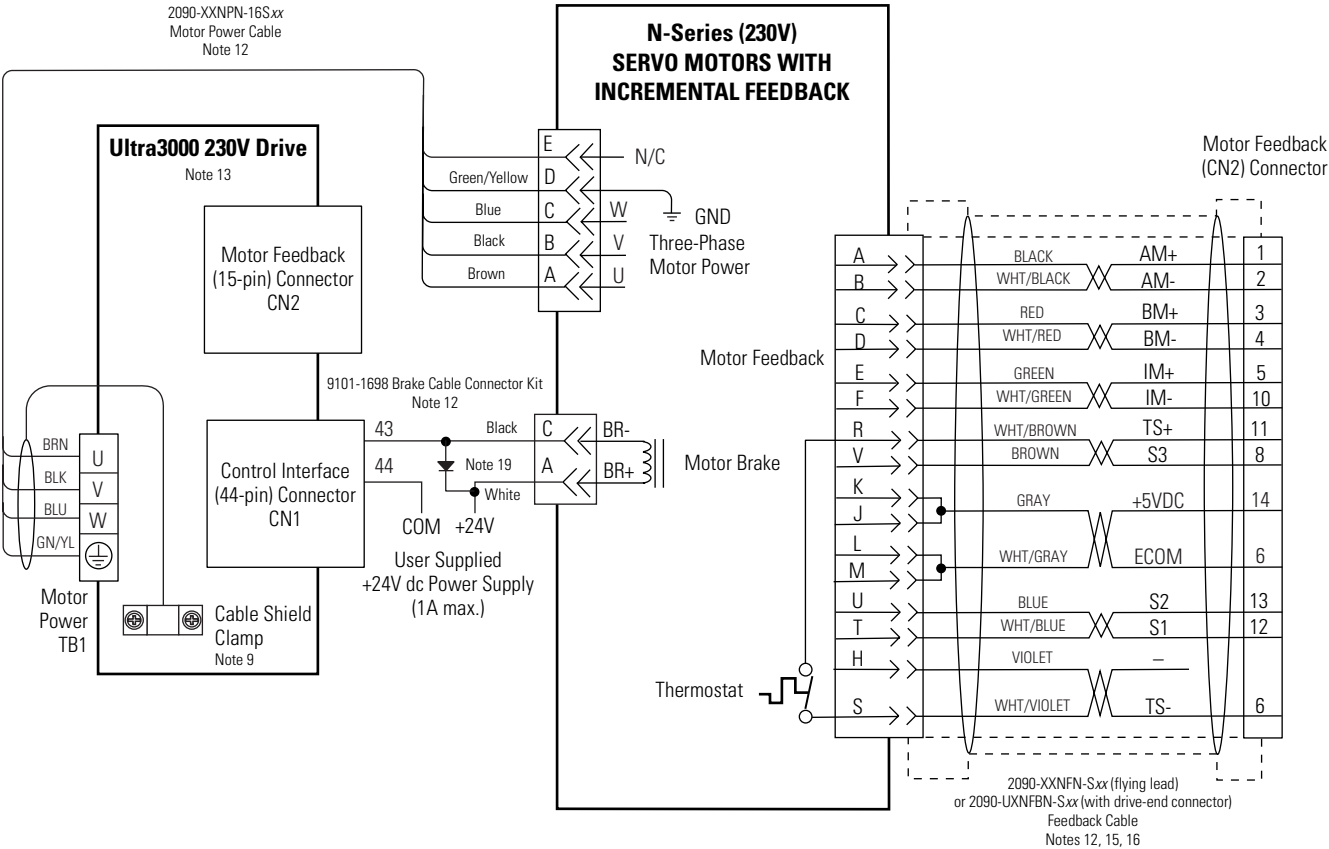


Figure A.13
Ultra3000 to H- and F-Series (230V) Motor Configuration



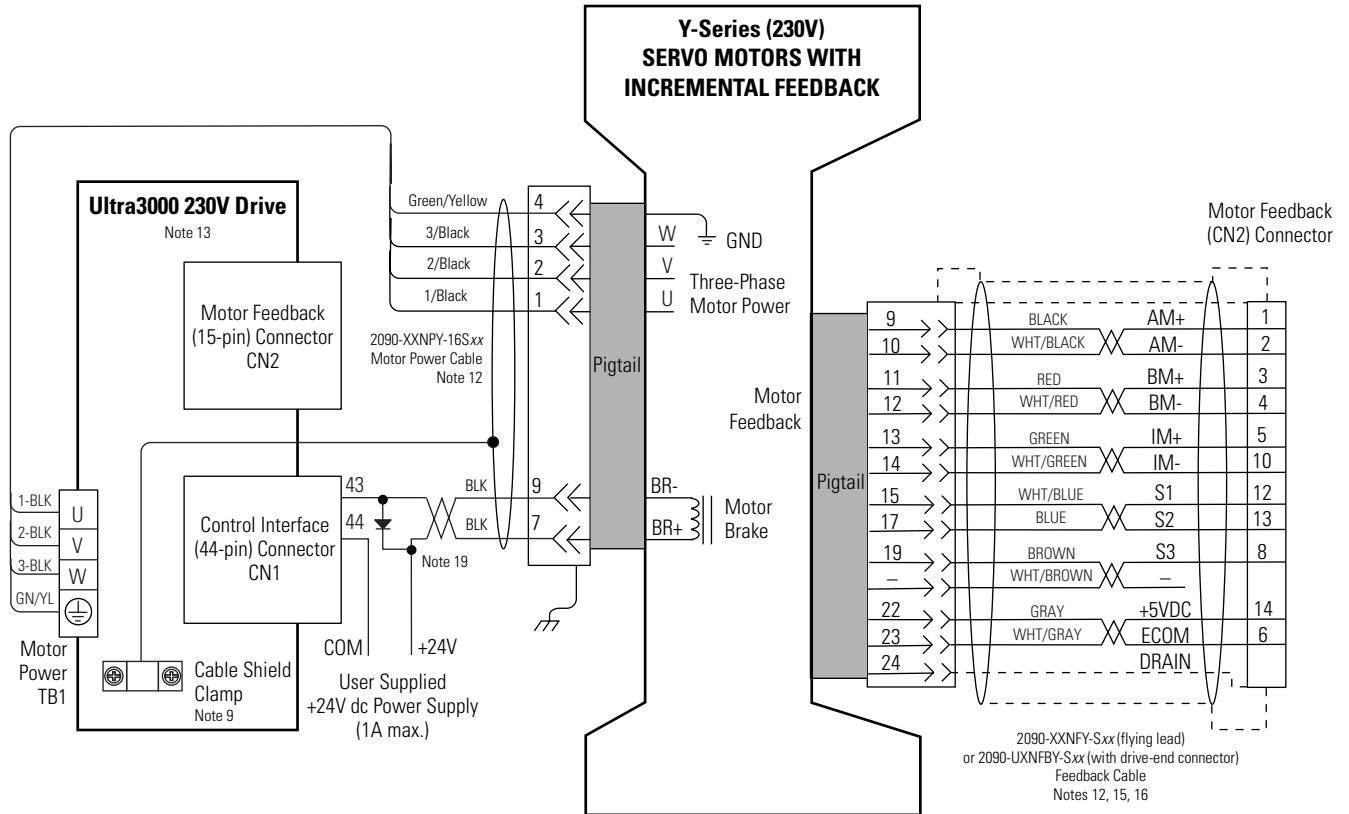
In the figure below, the Ultra3000 (230V) is shown connected to N-Series (230V) servo motors.

Figure A.14
Ultra3000 to N-Series (230V) Motor Configuration



In the figure below, the Ultra3000 (230V) is shown connected to Y-Series (230V) servo motors.

Figure A.15
Ultra3000 to Y-Series (230V) Motor Configuration




Control String Examples
(120V ac)

This section provides information to assist you in using the configurable Drive Ready output in a control string with 120V ac input voltage.

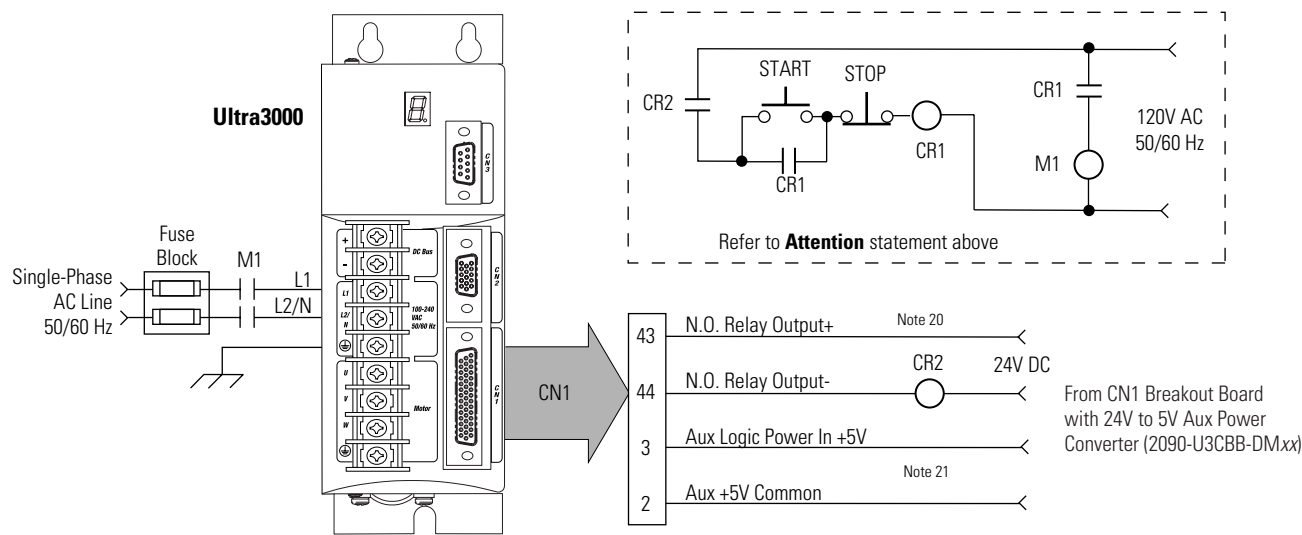
The 120V ac control string wired to the Ultra3000 (2098-DSD-005x-xx, -010x-xx, or -020x-xx) drives is shown in the figure below.

ATTENTION



Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure A.16
120V ac Single-Phase Control String Example



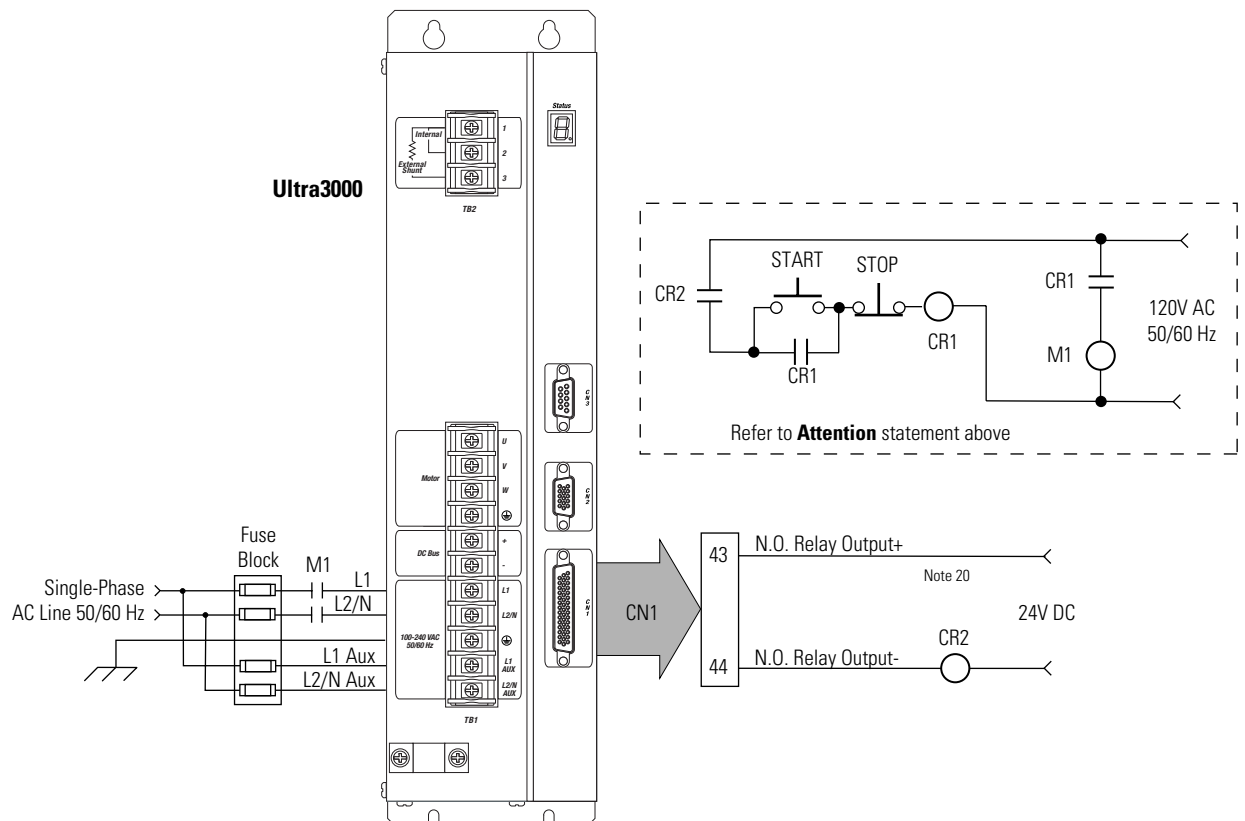
The 120V ac control string wired to the Ultra3000 (2098-DSD-030x-xx) drives is shown in the figure below.

ATTENTION



Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure A.17
120V ac Single-Phase Control String Example



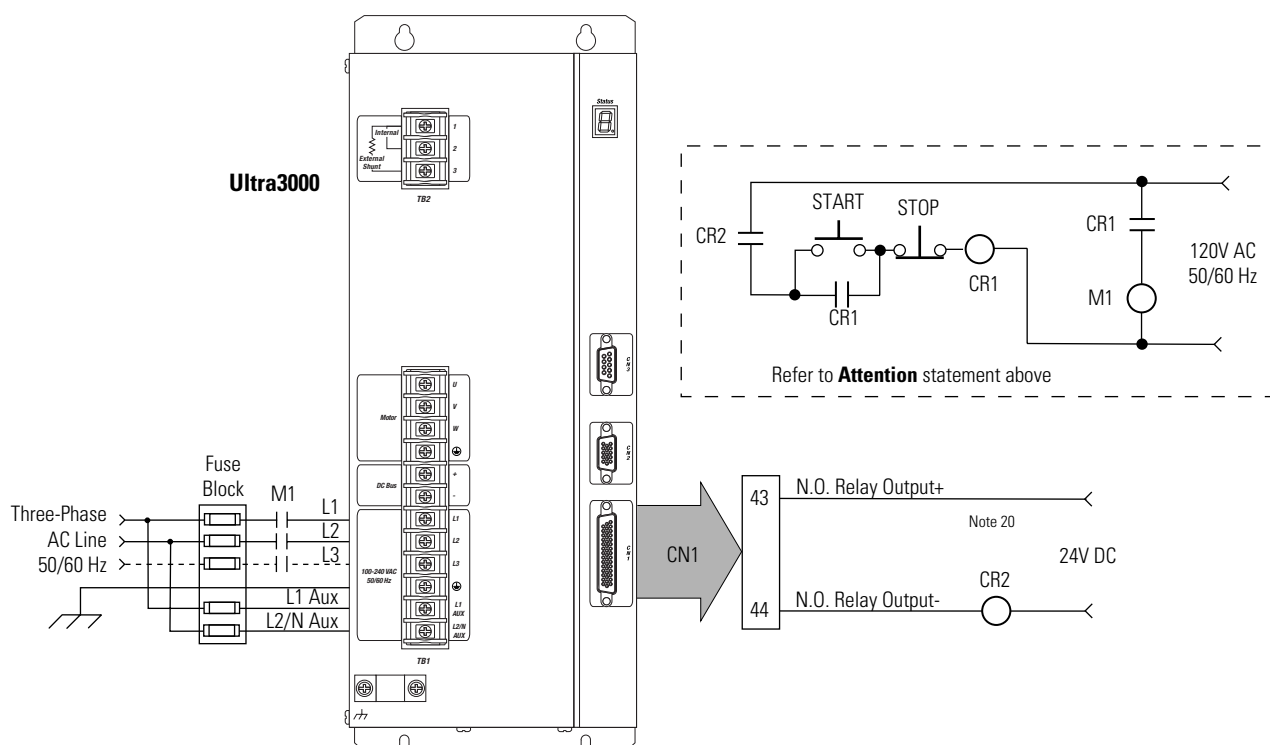
The 120V ac control string wired to the Ultra3000 (2098-DSD-075x-xx, -150x-xx, -HVxxx-xx, and -HVxxxX-xx) drives is shown in the figure below.

ATTENTION



Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure A.18
120V ac Three-Phase Control String Example



Controlling a Brake Example

The relay output of the Ultra3000 is suitable for directly controlling a motor brake, subject to the relay voltage limit of 30V dc, and the relay current limit of 1A dc. For brake requirements outside of these limits, an external relay must be used. If a transistor output is used, a control relay is also required.

The following table lists Allen-Bradley motors that are compatible with the internal relay output (CN1, pins 43 and 44), when used for controlling a brake. All other motors require an external control relay.

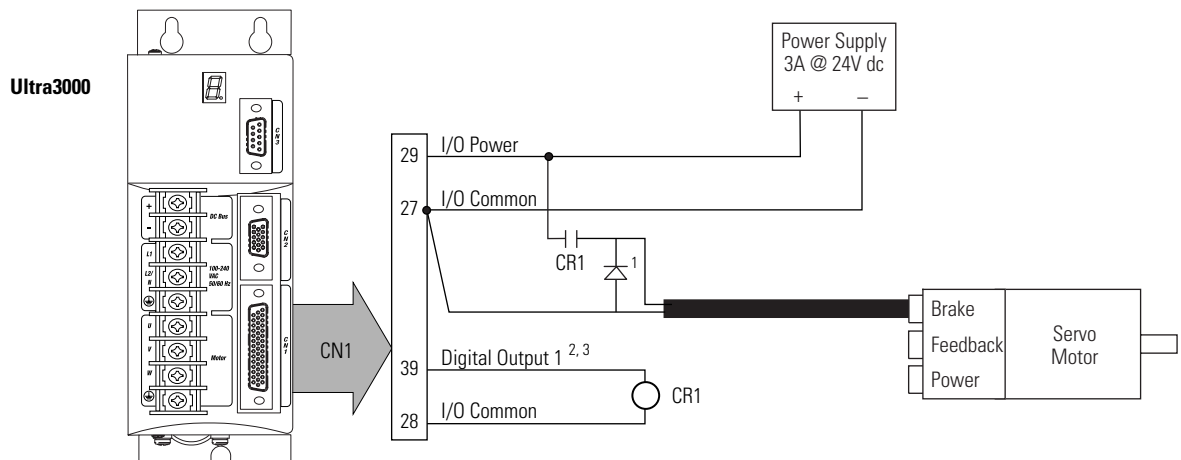
Compatible Brake Motors	Brake Current
F-4030, -4050, and -4075	0.88A
H-3007 and -3016	0.60A
H-4030, -4050, and -4075	0.69A
N-2302, and -2304	0.28A
N-3406, -3412, -4214, and -4220	0.36A
N-5630, -5637, and -5647	0.71A
Y-1002 and -1003	0.26A
Y-2006 and -2012	0.31A
Y-3023	0.37A

Compatible Brake Motors	Brake Current
MPL/MPF-x310, -x320, -x330 ¹	0.50A
MPL-x420, -x430, -x4520, -x4530, -x4540 ¹	0.64A
MPF-x430, -x4530, -x4540 ¹	
MPG-x004 ¹	0.33A
MPG-x010 ¹	0.45A
MPG-x025 ¹	
MPG-x050 ¹	0.50A
MPG-x110 ¹	1.0A
1326AB-B4xxx	0.88A

¹ Applies to 230V and 460V motors.

Figure A.19 shows an example configuration using Digital Output 1 and an external control relay to control a motor brake which exceeds internal relay ratings.

Figure A.19
Example Configuration Controlling a Motor Brake



¹ Flyback diode (1N4004 rated 1.0A @ 400V dc) suppresses collapsing field of brake coil.

² Digital Output 1 (pin 39) configured as Brake in Ultraware software.

³ For Digital Output 1 specifications, refer to the *Ultra3000 Installation Manual* (publication 2098-IN003x-EN-P).

IMPORTANT

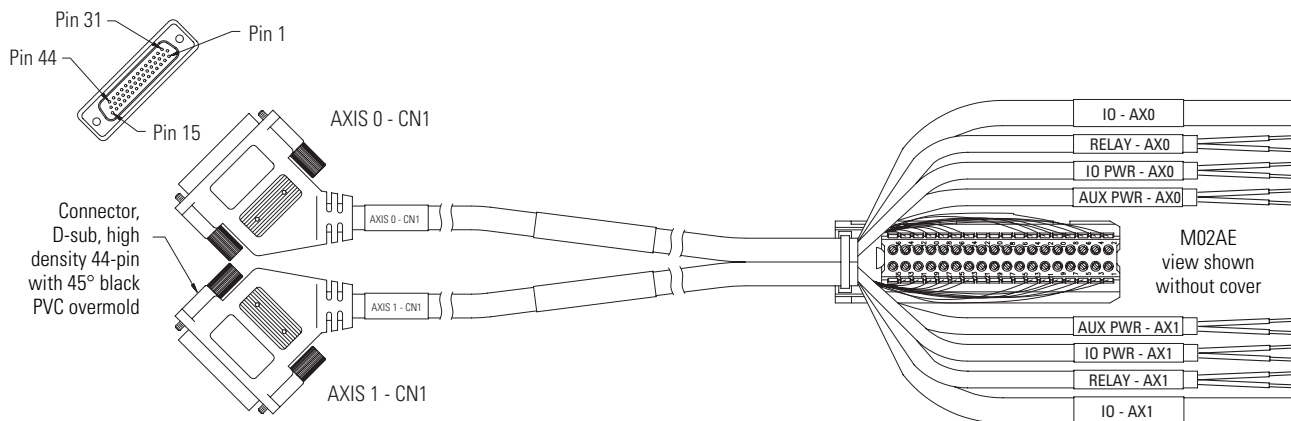
Flyback diodes must be used when controlling a brake coil with the relay or digital output.

Ultra3000 to Logix Cable and Interconnect Diagrams

This section provides information to assist you in wiring the Ultra3000 CN1 (44-pin) cable connector with either the ControlLogix 1756-M02AE servo module or SoftLogix 1784-PM02AE motion card.

Use the 2090-U3AE-D44xx control interface cable (shown below) when connecting two Ultra3000 drives to the 1756-M02AE servo module. This cable includes the 1756-TBCH pre-wired terminal block. Refer to Figure A.22 for the interconnect diagram.

Figure A.20
2090-U3AE-D44xx Two Axis Cable



Use the 2090-U3CC-D44xx control interface cable (shown below) when connecting a single Ultra3000 drive to either the 1756-M02AE (ControlLogix) servo module or 1784-PM02AE (SoftLogix) PCI card. The 1756-TBCH removable terminal block is required when wiring to the ControlLogix module. The 1784-PM02AE-TPxx termination panel is required when wiring to the SoftLogix PCI Card. Refer to Figure A.23 for the interconnect diagram.

Figure A.21
Control Interface Cable and Terminations

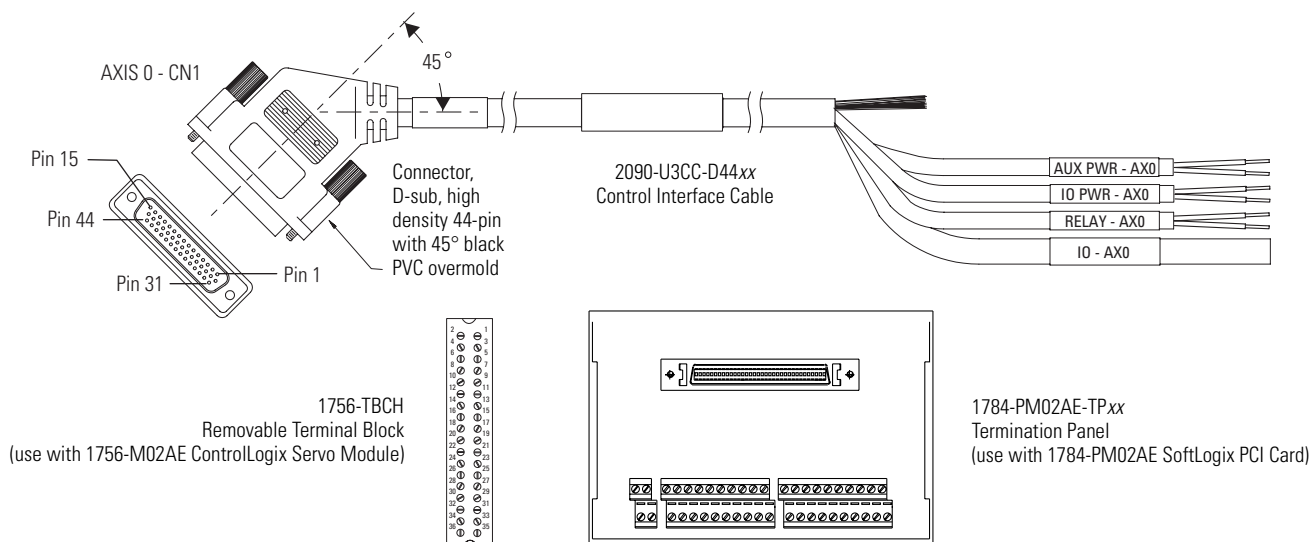
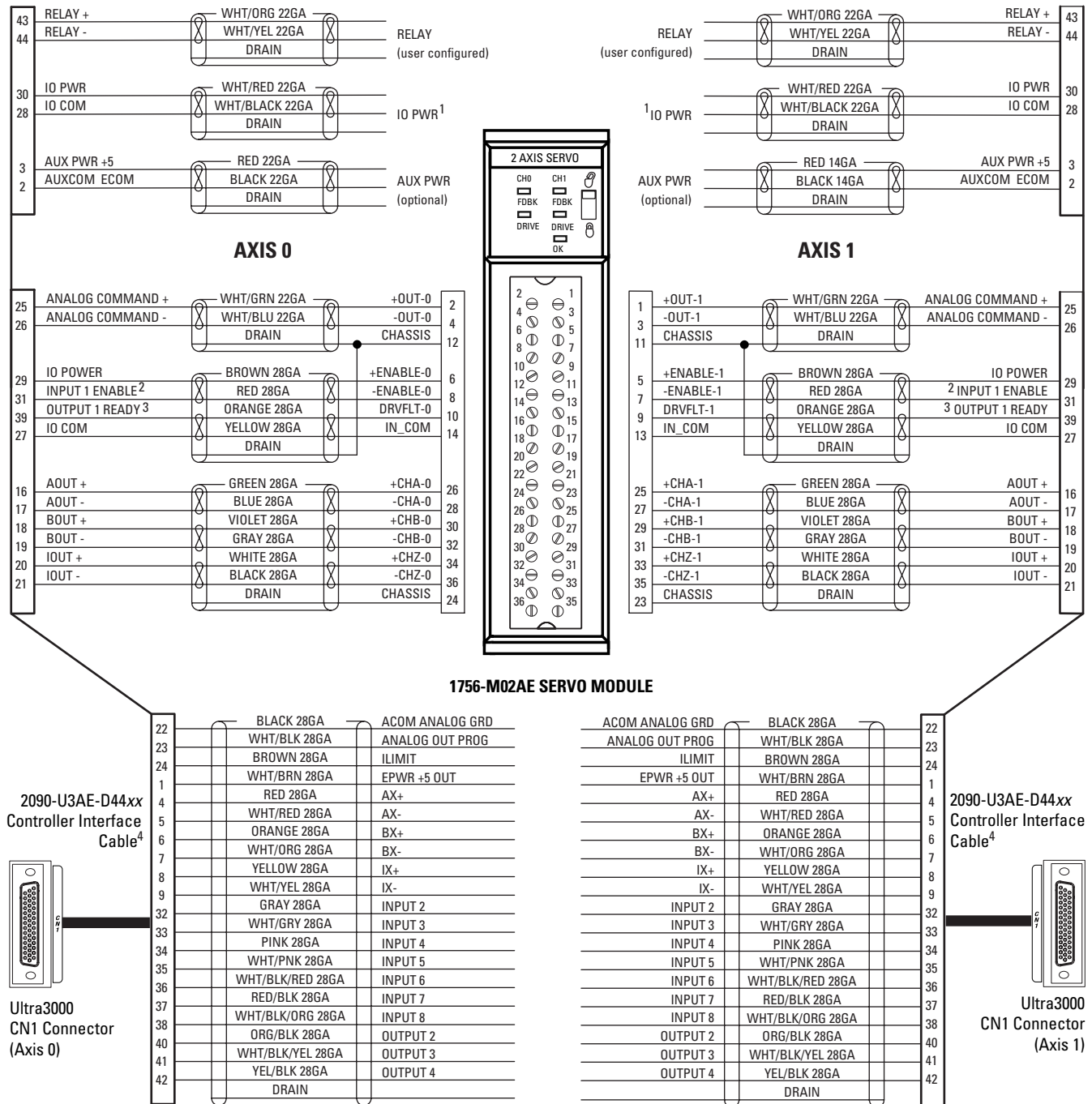


Figure A.22
Ultra3000 to ControlLogix Servo Module Interconnect Diagram



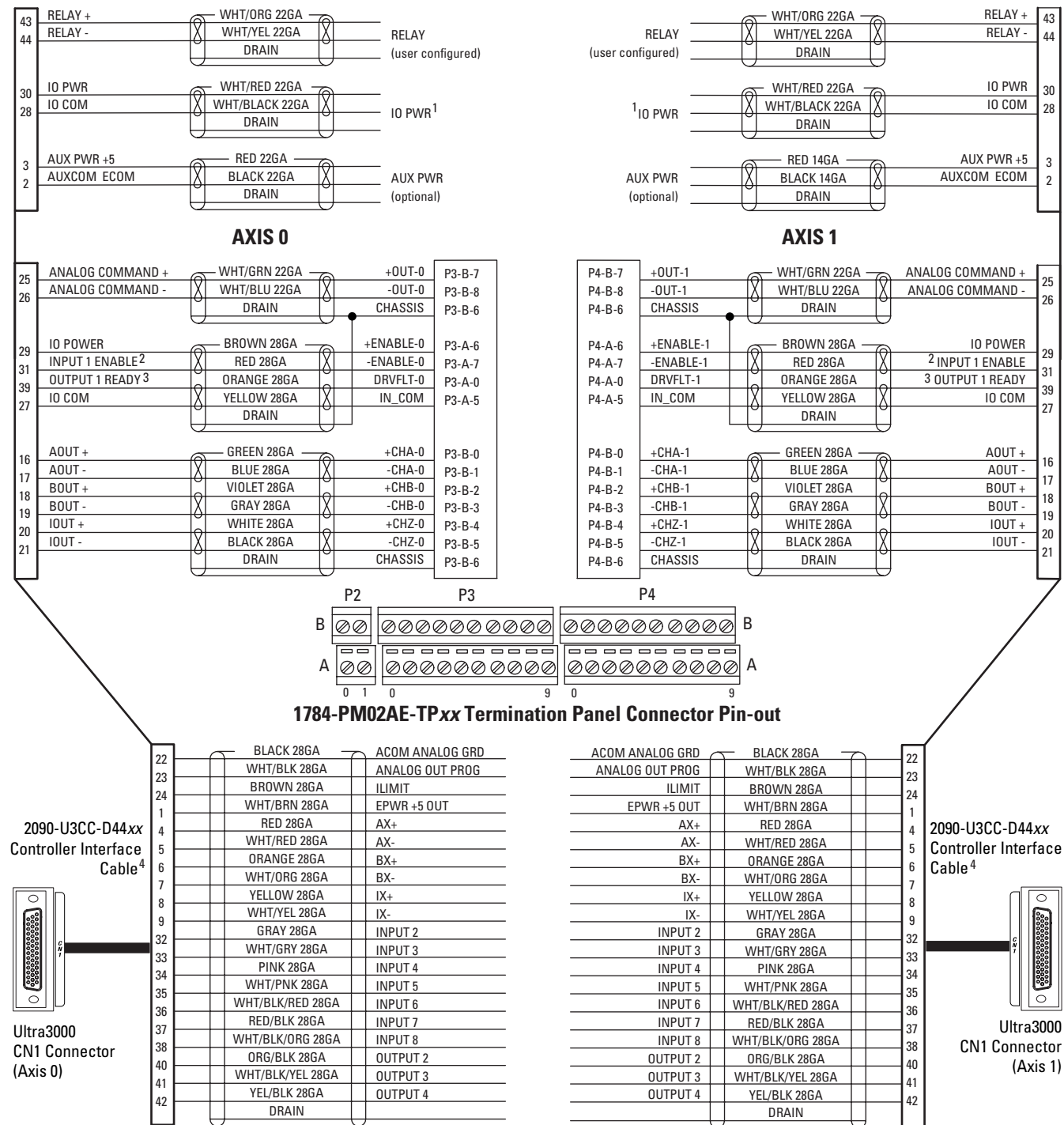
¹ I/O power (pins 28 and 30) must be connected to user-supplied 12-24V dc.

² Input 1 (pin 31) must be configured as Drive Enable using Ultraware software.

³ Output 1 (pin 39) must be configured as Ready using Ultraware software.

⁴ This cable does not carry the unbuffered motor encoder signals (CN1 pins 10-15). Contact your Allen-Bradley sales representative if these signals are required for your application.

Figure A.23
Ultra3000 to SoftLogix PCI Card Interconnect Diagram



¹ I/O power (pins 28 and 30) must be connected to user-supplied 12-24V dc.

² Input 1 (pin 31) must be configured as Drive Enable using Ultraware software.

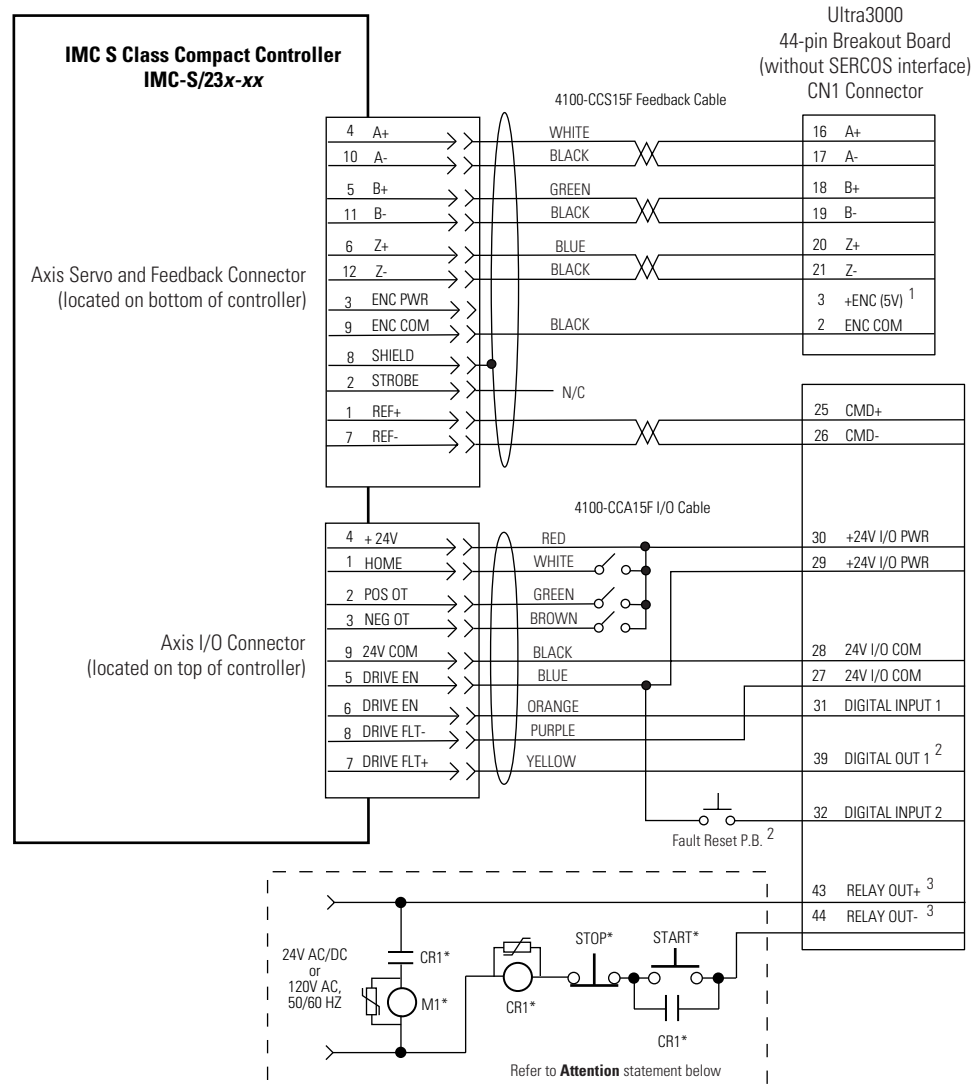
³ Output 1 (pin 39) must be configured as Ready using Ultraware software.

⁴ This cable does not carry the unbuffered motor encoder signals (CN1 pins 10-15). Contact your Allen-Bradley sales representative if these signals are required for your application.

Ultra3000 to IMC-S Compact Cable and Interconnect Diagram

This section provides information to assist you in wiring the IMC-S/23x-xx Compact Controller when connecting the 4100-CCS15F feedback cable and 4100-CCA15F I/O cable to your Ultra3000.

Figure A.24
Ultra3000 to IMC-S/23x-xx Compact Controller Configuration



¹ The preferred method for supplying the auxiliary +5V is by using the 12- or 44-pin drive mounted breakout board with 24V to 5V auxiliary power converter (catalog number 2090-U3CBB-DM12 or -DM44). Auxiliary +5V power is required to maintain encoder position with an external position controller during a controlled stop condition.

² Drive Enable and Fault Reset are configured in Ultraware software.

³ Relay Output (CN1, pins 43 and 44) must be configured as Ready in Ultraware software.

ATTENTION



Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Understanding Motor Feedback Signals and Outputs

Chapter Objectives

This appendix contains motor encoder input signal information and drive encoder output information specific to the Ultra3000 drives. The following motor encoder types are included:

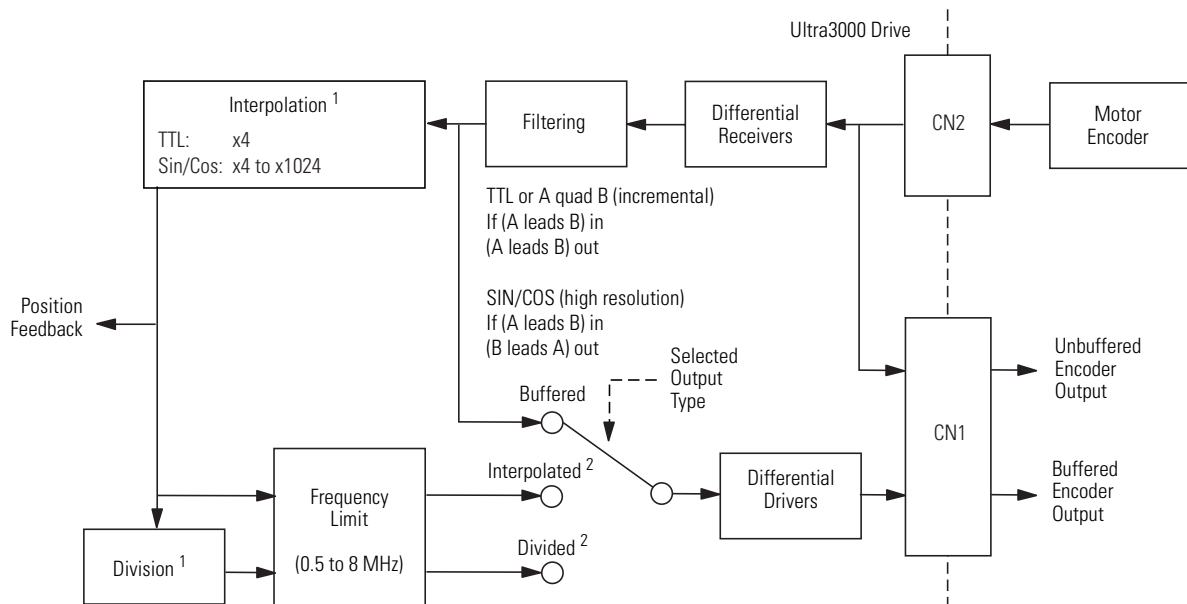
- High resolution SIN/COS encoders
- Incremental A quad B encoders

Introduction

The Ultra3000 is compatible with motors equipped with both incremental A quad B or high resolution (Stegmann Hiperface®) SIN/COS encoders.

The buffered motor encoder outputs use RS-485 differential drivers and have a maximum signal frequency of 2.5 MHz. The drivers can drive a 2V differential voltage into a 100 ohm load. Use the block diagram below to follow the motor encoder input through CN2 to the buffered and unbuffered outputs on CN1.

Figure B.1
Motor Encoder Outputs



¹ Interpolation and division operations are performed in firmware and the resulting output frequency is updated at 250 μ s intervals.

² Interpolated and divided output not available on SERCOS drives.

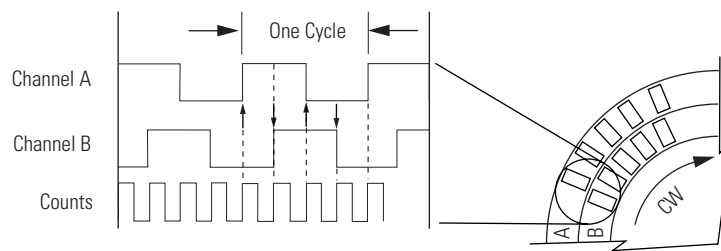
Unbuffered Encoder Outputs

The unbuffered outputs available from the drive (CN1-10 through -15) are tied directly to the incoming (incremental or high resolution) encoder signals (CN2-1 through -6). The unbuffered outputs are not filtered or conditioned.

Incremental Encoder Output

Incremental encoder counts are generated in the drive by counting the (high to low and low to high) transitions of the incoming A and B encoder signals. In Figure B.2 the channel A signal has two transitions, as does the channel B signal, which results in x4 interpolation (4 transitions/line equals 4 counts/line). For example, typical 2000 line/rev encoder output becomes 8000 counts/rev in the drive. Counts are not directly available at the encoder outputs, only the A quad B representation.

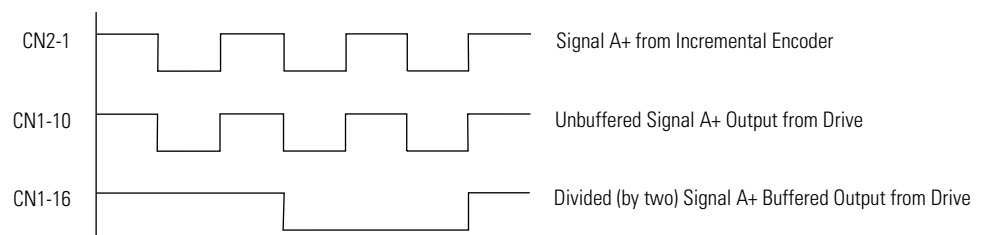
Figure B.2
Incremental Encoder Counts



The incremental buffered outputs (listed below) are available from the drive (CN1-16 through -21) and software selectable.

- **Buffered Outputs** are a filtered representation of the original incoming encoder (CN2) signals. Buffered outputs have the same number of cycles/rev as found on CN2.
- **Interpolated Outputs** are the same as buffered outputs when using an incremental encoder. The only interpolation performed on an A quad B signal is the drive's internal counting of transitions (4 counts/line). Because counts are not available outside the drive, selecting this in software is the same as selecting buffered (as described above).
- **Divided Outputs** are the same as buffered outputs, except when divided is selected in the software, the lines/rev are then reduced by the value of the divisor chosen in the software (as shown in the figure below).

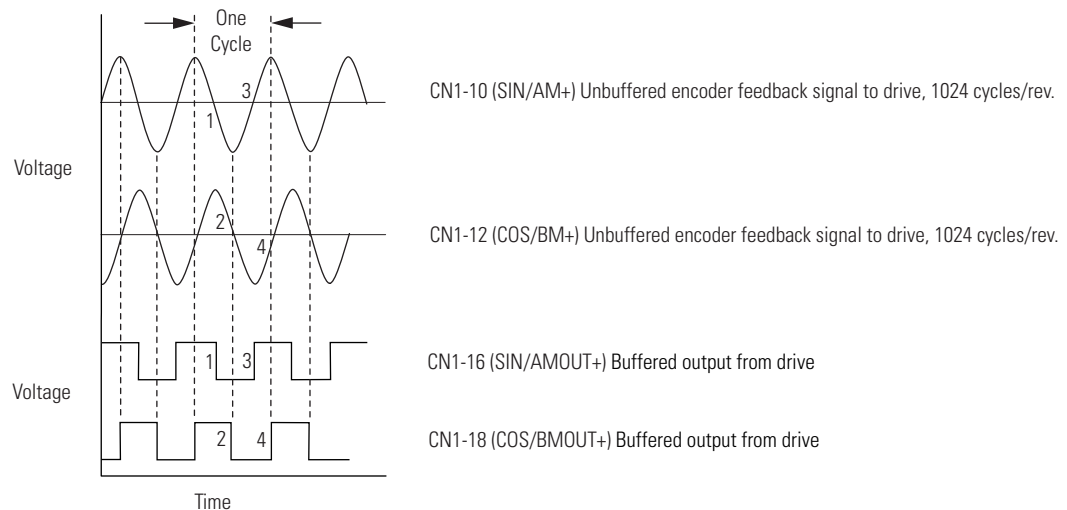
Figure B.3
Incremental Encoder Divided



High Resolution Encoder Output

When the incoming encoder feedback on CN2 is a high resolution (SIN/COS) signal, the drive is capable of generating more than just 4 counts/cycle (as with incremental encoders). The Ultra3000 drive is capable of breaking the SIN/COS encoder signals into as many as 1024 counts/cycle. For example, a 1024 cycle/rev SIN/COS encoder can result in 1024 x 1024 (high resolution) counts/rev.

Figure B.4
Absolute High Resolution Encoder Signals



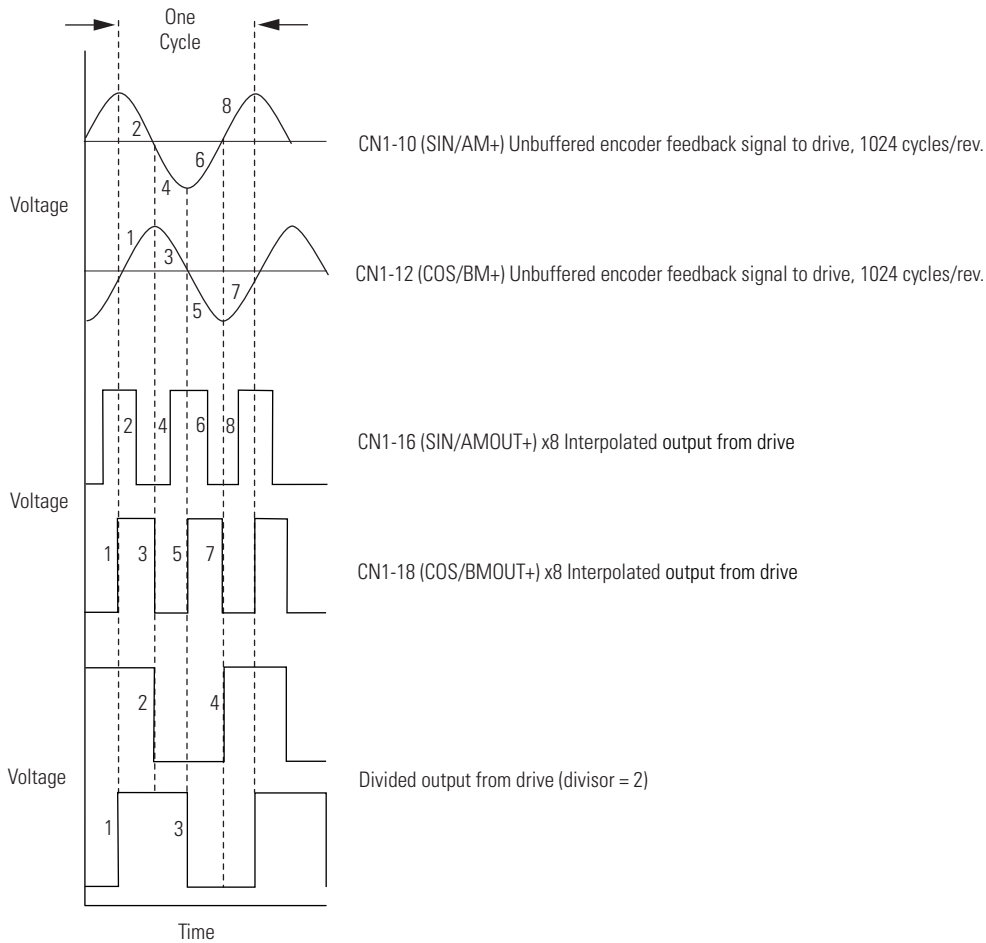
The high resolution buffered outputs (listed below) are available from the drive (CN1-16 through -21) and software selectable.

- **Buffered Outputs** are conditioned SIN/COS signals resulting in a square wave (A quad B) signal (refer to Figure B.4). This signal will have the same number of cycles/rev as the incoming SIN/COS encoder signals found on CN2.
- **Interpolated Outputs** are square wave (A quad B) signals reflecting the interpolation value chosen in software. The minimum interpolation value allowed is x4, which gives the same output as selecting buffered (as described above).
- **Divided Outputs** are the result of a divisor (selected in software) and an interpolation value (also selected in software). For example, with an interpolation value of x8 and a divisor of 2, the CN1 buffered output will be the (x4) square wave representation of the original incoming SIN/COS signal from CN2.

IMPORTANT

The interpolation value selected in software is what the drive uses internally to close the feedback loops regardless of any divisor value chosen to condition the signals present on CN1.

Figure B.5
Interpolated and Divided Absolute High Resolution Encoder Counts



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